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OFFICE AUTOMATION
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Nicholas A. Ashford

M.I.T. Center for Policy Alternatives

Prepared for the
Office of Technology Assessment
Congress of the United States
Washington, DC 20510

December, 1984

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THE IMPACT OF OFFICE AUTOMATION ON THE QUALITY OF WORKLIFE: POLICY IMPLICATIONS

Nicholas A. Ashford*, Ph.D., J.D.

I. Scope of the Paper

The impact of office automation on the quality of worklife has major implications for two key areas of policy design, those which stem from primary impacts and those which stem from instrumental impacts. Primary impacts are the effects of office automation on 1) health and safety, 2) job characteristics and design, 3) employment, and 4) the diffusion and development of new technologies. Instrumental impacts describe the effects of office automation on 1) labor law, 2) collective bargaining and other union activity, and 3) worker self-help actions. The term "office automation" refers specifically to the introduction and utilization of new office technologies.

Although there are several different types of office technologies currently in use: printers, reproduction machinery, etc., this paper will address only video display terminals (VDT's). VDT's are the most widely used form of office technology, and act as the heart of most automated office workplaces, controlling printers, data communication facilities, and electronic mail. These devices are also the major focal point in current debate on various health and safety issues.

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* Associate Professor of Technology & Policy, and Director, M.I.T. Center for Policy Alternatives.

Specifically, discussion of VDT usage could include areas such as accounting, retrieval, mail, composition, and editing/correction. This paper focuses only on policy implications of the latter two usages.

The categories of workers who use VDT's can be categorized into 1) executives/managers, 2) professional employees, and 3) clerical staff. These divisions are based upon typical office hierachical patterns as noted by Chamot (1984).

In the next two sections of the paper are presented a brief discussion of the problems resulting from VDT adoption and usage in the office workplace, and the policy implications of both primary and instrumental impacts as described earlier.

II. Problems Related to the Adoption and Use of the Technology

The problems encountered by automated office workers who work with VDT's fall into several categories. Physical effects, stress (VDT usage) effects, job-restructuring, organizational effects, derived stress effects, and employment effects. This paper explores various aspects of each of these effects, their consequences for the quality of workinglife, and policy issues raised by the new technology.

A. Physical Effects

Adverse physical effects experienced by office workers can be viewed in three ways: 1) those which are ergonomically-related, 2) general radiation-based problems, and 3) reproductive hazards caused by radiation and stress.

Physical problems which stem from ergonomic sources have typically been supported both by scientific data and general concensus. (Smith 1982) (Osterberg 1977) One reason for this support is because many of these types of problems, such as improper chair height leading to poor circulation in the legs, are easily observable and clearly casual in nature.

Ergonomic problems which are specific to VDT usage take many forms. One of the more common areas of concern is eyestrain. Eyestrain and vision impairment may occur due to factors such as poor office illumination, VDT screen glare, and long periods of constant VDT use coupled with infrequent rest breaks. (Arndt/Chapman 1984) (NIOSH 1981)

Another important problem is workstation design. Frequently, workstations which were designed specifically for typewriter usage are equipped with VDT's, but without any modification of existing space. Since VDT's are generally larger than typewriters, space is an important consideration for optimal machine usage. (Studies by Amick have shown that workers frequently end up adjusting themselves to a poorly designed/arranged workstation.) As a result, increased incidences of backaches, headache, Carpal Tunnel syndrome, and other subtle impairment of mobility have been noted by several researchers. (Stellman 1983)

The three major components of workstation design; lighting, table/desk design, and chair design are key factors to consider during changeover to an automated office setting. Although many ergonomic problems can be costly to remedy, renovated lighting being one example, the expense to a company in terms of increased sick leave and/or incidence of absenteeism may be a costlier long term solution.

VDT's as a source of both ionizing and non-ionizing radiation are another major area of concern for office workers. However, the data which currently exists in this area are not yet unequivocal, and the available studies often ignore standards of good epidemiologic design and lack sufficient analysis. (Arndt/Chapman 1984) One example of this is testing which shows little radiation emission from the front of the VDT screen, but ignores the fact that there may be non-ionizing emissions from the back of the monitor which could affect a worker sitting across from the machine rather than the worker facing it. (Slesin, Conference on Office Automation 1984)

Information concerning VDT's as a source of inoizing raditation is well-known. But non-ionizing radiation is of particular concern, since there are no emission standards or guidelines in place as exist for ionizing radiation (NIOSH 1981). Due to the longer wavelengths in the non-ionizing portion of radiation, penetration into any organs of the body is deeper than that of ionizing radiation. Given the deeper penetration of non-ionizing radiation, the potential for adverse health effects is different than that found with ionizing radiation. There is clearly a need for more detailed research studies in the area of non-ionizing radiation, which would hopefuly result in standards and/or guidelines for emissions.

As far as drawing clear causal relationships between actual VDT radiation exposures and adverse health effects which are non-reproductive in nature, there is insubstantial evidence to support any type of risk/hazard analysis. However, it should be emphasized that the lack of clear data may be due in part to the small number of studies which have looked at this problem.

One possible and fairly inexpensive solution to VDT microwave emissions, is to install prefabricated lead shielding in the VDT. This reduces emissions to non-measurable levels. (Arndt/Chapman 1984)

The problems resulting from VDT microwave emissions on human reproduction are again unclear based on available data. Although this is a widely-perceived problem, particulary for pregnant women experiencing miscarriages, a clear causal relationship between adverse pregnancy outcomes and radiation emissions has not been established. (Slesin/Zybko 1983)

Stress related to actual worry over real or imagined problems with VDT usage during pregnancy may also be a major factor in adverse pregnancy outcomes. (Strauss 1974)

Many companies have prudently chosen to offer pregnant workers the option of transferring to non-VDT work during pregnancy. (Slesin/Zybko 1983) Stress itself has repeatedly been shown to be a major health problem in companies both with and without VDT's and will be further discussed in this paper.

B. Stress Effects Related to VDT Usage

Stress effects/problems resulting from VDT usage primarily take various forms of psychological disorders rather than documented neurologic findings. These include emotional problems: anxiety, alcoholism and absenteeism. (Wall Street Journal 1983)

Emotional problems such as anxiety are frequently caused by worry over job loss due to replacement of jobs by VDT's. Job loss has recently become a major issue amongst the few clerical unions currently in existence. This is due to the fact that many simple, redundant tasks such as processing of claims forms, are being replaced by computers. Anxiety is also caused by the fear that there will be an increase in part-time work schedules which do not provide benefits packages. This problem is roughly equivalent to the sweat shop problems of the turn of the century. VDT's are portable, and therefore very easy to install in the home. Homework usage of VDT's could lessen the need for full time employees at the worksite, hence the potential for an increase in part-time low benefits positions, and a decrease in full-time, full benefits work. (Chamot 1983) (Gregory 1983)

Anger and boredom are also commonly reported in the surveys (Strauss 1974). VDT monitoring of clerical workers in large insurance companies, the telephone service, and other business offices is one common cause of anger in particular, and frequently leads to some of the highest stressful outcomes (headaches, non-specific health effects) (Stellman).

Monitoring includes logging in and out for both work and rest breaks, work-load completion tracking, and may even be as detailed as reports on specific data such as keystrokes per hour or minute per individual. Clerical employees who are aware that every VDT operation is monitored may easily experience high levels of anger/stress, especially when the higher categories of worker (professional employees, managers, executives) are not monitored. (Stellman 1983)

Bordeom frequently occurs amongst clerical employees due to the stratification of their tasks, which may become extremely limited in scope on a VDT, and redundant in nature. Little or no control over job design may aggravate this problem, again leading to stressful work experience. (Amick 1984)

Inappropriate behavior patterns due to the same problems discussed in the preceeding paragraphs may also be viewed as indications that VDT usage can lead to stress. These include problems such as alcoholism, drug abuse, and increased absenteeism/sick leave. Based on available data, there appears to be an increased incidence of these behaviors amongst VDT operators, especially those who are monitored, compared to workers who do not operate VDT's. (Wall Street Journal 1983)

C. Job Restructuring

The skills required of clerical workers using VDT's change dramatically depending on the following factors: type of machine/computer, type of software program(s) the machine/computer runs, and task. Job restructuring is an integral part of automating an office, because the changes in the clerical skill base are often so great. (Walton 1982) In this sense, training of the clerical workers, both new and continuing, should be regarded as a key goal for employers and unions.

The interaction between the specific office technology / machines / computers, and the assigned task(s) is central to job structure. Once the equipment and software have been chosen, the worker is immediately limited by the technical capabilities of the machinery.

For example, if a worker is given an IBM PC with Microsoft's word processing software, and told to type up a memo, the worker will have to be trained in order to carry out the task properly. There is nothing intuitive about using a VDT/computer for the first time, just as a typewriter keyboard is foreign to the touch until properly taught. In fact, the only familiar thing about most VDT's is that the rudiments of the basic typewriter keypad have been retained. However, even this is changing with the advent of a new, and much "faster" keypad called "Dvorzak". There is also an entirely new nomenclature associated with computers that must be learned, even for the most basic operations.

The specific equipment being used by the worker becomes an important issue if the company decides to upgrade it. There is a great variety of office computer equipment, which is also becoming much less expensive to purchase. If a worker is trained to use an IBM PC, and the company decided to changeover to Macintosh machines, retraining would be required before the worker could perform the same functions on Macintosh equipment. This is a problem which, depending on similarity or dissimilarity of the equipment, will occur each time new technology is upgraded or changed. Without a contract clause which specifically addresses the need for retraining, a clerical strike could be easily broken by a group already trained to operate the new equipment.

Thus, training is a key issue in job design at any level of the business heirarchy, particularly for clerical workers if they are to avoid future strike-breaking or job loss, and one which will most likely become a major topic in any future union or general contract discussions.

D. Organizational Effects

Organizational changes due to the introduction of VDT's into the workplace has had major impacts on the clerical categories of workers more than the professional employee/manager/executive categories. The impact on the lowest supervisory levels of management is still minor, though growing. (Chamot 1984) Tasks have been broken down and made redundant, monitoring has been instituted, intra-office organization amongst the clerical workers has impacted power/control structures, and homework/piecework reminiscent of sweat shop structures is becoming an issue. (Gregory 1983)

Perhaps the major reason for such multifaceted organizational impacts is the fact that VDT's are able to handle huge quantities of almost any type of data. This alone would be no different than having a gigantic library available in a very small space. The key difference is in the manipulation and rapid retrieval time of the data. Once access, manipulation, and transfer of information is reduced to minutes on one central machine, control of a variety of types of data becomes very easy. However, the data which are entered into a VDT is only as accurate as the operator, hence the institution of monitoring to control input mistakes. Accuracy becomes an important focus of the clerical task, because clerical workers enter the data, whereas the managers, professional employees and executives generally only use and develop the information which is inputed by clerical staff. This results in strong support of monitoring by management interested in cost-effective measures/efficiency. Since there are currently few unions or other power structures available to clerical workers interested in changing the organizational structures, efforts to halt monitoring, increase rest breaks from the machine, and restrict company participation in homework projects have not generally been successful. (Nussbaum, Conference on Office Automation 1984)

Walton (1982) notes that there are bimodal impacts on the various divisions of workers which have important implications for the use of new technologies in the office workplace. These include both positive as well as negative impacts, but the negative impacts seem to affect the clerical and lower level management positions more than upper level professional and executive positions. The negative impacts are job deskilling, leading to loss of motivation, status, and self-esteem, increased specialization of tasks, leading to boredom and alienation, and stress. The positive impacts are increased schedule flexibility, some upgrading of positions, and increased access to overall company operations. If the change to an automated setting is planned in advance, the negative impacts may be lessened.

E. Derived Stress Effects

Apart from stress directly related to VDT usage, organizational change frequently results in a stressful environment for employees, especially in changing to an automated office. This is seen with changes as they affect task/job design, loss of control/power within the office setting, and replacement of available positions by the technology. (Walton 1982)

Change in the nature of the task, (i.e. - how the task is performed) is significant whenever VDT's are introduced into the office. A worker can experience extreme anxiety, because the tasks which were previously performed manually can now be carried out on one machine. These include correspondence and complex billing chores. The change from a manual typewriter to an electronic typewriter is simply mechanical. The technical impact is mainly one of increased typing speed. But change from any type of a typewriter to a computer requires memorization of commands for even the most basic procedures. This causes learning anxiety and feelings of insecurity. (Walton 1982)

Job loss/replacement of workers by technology is primarily a problem for clericals. Although baseline task supervisors are being threatened by more advanced technologies, such as laboratory databanks, clerical workers take the brunt of the burden. This is because the technology is still very rudimentary, and can only replace basic tasks which do not require decisionmaking. Management, professional employees, and executives use the information/data generated by the computer(s) to make decisions. Since the structure of the tasks performed in these positions is different, clerical workers cannot share their anxieties with management, further separating the categories of privilege and communication.

The potential for a major division in job categories, those who use the most advanced technologies with access to training, and those who do not, is growing. Those in the latter category may eventually include large segments of management, depending on which portions of the task process are impacted by the new technology. These workers will become increasingly isolated from control strategies, increasing tension and dissatisfaction with various categories of work. (Chamot 1984)

Intra-office organization is important in two respects . . job design, and power/control. The need for input from clerical workers when changing to automated office setting is primary, otherwise feelings of helplessness in a situation where technology/tasks are also changing may result in high levels of absenteeism and stress. (Chamot 1983)

F. Employment Effects

The introduction of the VDT into the office workplace will have significant effects upon employment. The greatest influence will occur first amongst clerical and middle management staff, as opposed to professional employees, and upper management and executive positions. (Chamot 1984) This is due to the fact that computers are still in rudimentary stages as far as replacing the decisionmaking process, and are equipped to perform only a limited number of mechanical tasks. However, the eventual threat to basic clerical functions such as typing, filing, some mail chores, and billing could be a major problem for those unable to obtain retraining into other areas of work.

The possibility for generation of new jobs in the clerical area is yet unclear, because widespread introduction of VDT's is only in the beginning stages. Given this uncertainty, ongoing training of clerical staff should be considered a major priority of employers and unions alike.

III. Identification of Key Policy Issues in Need of Resolution

The importance of developing policy to deal with the problems resulting from the introduction and usage of office automation has been recognized by several commentators. (Arndt and Chapman, Chapter 4, 1984), (Kennedy, Craypo and Lehman 1982), (Marschall and Gregory, Section V, 1983), (Cohen 1984)

In this section are discussed the key policy issues related to both primary impacts and instrumental impacts. In the first grouping are discussed policy options and questions for ameliorating adverse effects of office automation technology by utilizing existing political and legal mechanisms, without changing fundamental power relationships or postures of the major actors. For the second set of impacts, policy issues relating to restructuring fundamental relationships and encouraging new initiatives which go to more systemic changes are discussed.

A. Primary Impacts

1. Health and Safety:

The following discussion describes these approaches for addressing health and safety concerns:

Federal Regulation of Health and Safety Hazards

Engineering, informational and administrative standards for the protection of workers exposed to office automation technologies may need to be developed. Engineering standards include guidelines for ergonomic, radiation and reproductive hazards. The key policy issues are:

- How do we ensure a sufficient scientific basis for establishing these guidelines, given the great uncertainty in the data and epidemiological methodologies employed?
- How do we encourage more research by both government, academe and the private sector? Who should fund the research?
- How do we encourage the utilization of foreign research in the establishment of those standards?
- What should be the mixture of standards imposed upon users (employers) and upon the designers of office equipment, i.e., OSHA vs. CPSC regulation?
- Should we fashion standards differently for new technology vs. retrofit solutions?

Informational standards include product labelling, instructions for proper use, record keeping by the employer-user and training guidelines, all of which transfer information to both employers and workers to ensure proper utilization of the technologies. These standards could be adopted by OSHA and/or the Consumer Product Safety Commission.

Key policy issues include:

- How does one decide on the mixture of OSHA, CPSC, NBS, and HHS, etc. regulation?
- Since OSHA's Hazard Communication Standard applies to the manufacturing environment only, what is the best strategy for ensuring an adequate OSHA response?

Administrative standards include the requiring of rest breaks, periodic medical examinations and medical removal protection to ensure job and wage security. The key policy issues are:

- How do we ensure that the standards have a sufficient scientific and factual basis?
- In the face of uncertainty, to what extent should we err on the side of caution to prevent major health and safety problems?
- How do we ensure that workers are not dismissed from the job because they are developing health and safety problems?

In addition to the promulgation of standards, how can we be assured that these standards will be enforced? Key policy issues are:

- What mixture of random inspections and worker complaints should guide OSHA's response?
- How can we ensure a coordination of federal efforts?
- How can we create standards and enforce them, while ensuring that new technology can be encouraged to replace less protective technology?
- Can we use regulation to define market opportunities for new responsible technology?

- Can Federal (or state) procurement practices and standards be utilized to improve the technology?

Aside from federal standards, what other instruments, such as the NIOSH HHE and technical assistance, or OSHA consultation should be used.

State Regulation of Health and Safety

The key policy issues are:

- How can we ensure that those states with and without OSHA State Plans sufficiently protect public employees from the hazards of office automation?
- To what extent should we encourage the states to pass separate VDT legislation for the protection of workers? What should the legislation provide? What state instruments should be used?
- How can federal and state efforts best be coordinated?
- Will this legislation be preempted by federal OSHA efforts?

Private Sector Initiatives

The key policy issues are:

- To what extent should we encourage voluntary standards development?
- How can we encourage the private sector to anticipate health and safety concerns in the design and or use of their equipment by voluntary measures?
- To what extent can federal or state procurement be used to improve the safety of office technologies?
- How can we encourage unions to seek solutions through the collective bargaining process?
- Should we encourage unions to organize non-union workers in order to protect them from health and safety hazards?
- What worker self-help actions should be encouraged to protect the unorganized worker?

2. Job Restructuring and Other Organizational Changes

Recently Walton (Walton and Vittori 1983) (Walton 1984) has categorized the major problems facing workers and unions in the context of office automation. Walton lists 9 effects of the new technologies as follows:

1. Employment effects
2. Relocation effects
3. Health and safety effects
4. Bargaining unit effects
5. Skill and income effects
6. Job qualification effects
7. Job advancement effects
8. Job control and job pressure effects
9. Job satisfaction effects

He argues that unions have been more successful in addressing the effects on the first half of the list than the latter half. The key policy questions are:

- o Are the collective bargaining efforts sufficient to bring about mutually beneficial job restructuring and organizational change?
- o How can the vast majority of workers, especially clericals, who are not unionized get the attention of management to institute changes which are mutually beneficial?
- o How can we increase all workers' participation in job redesign?
- o What training and other initiatives (public and private) should be considered in order to respond to the deskilling effect in some situations, and in others to ensure the acquisition of an increase in

skills to meet opportunities created by new jobs demanding higher skills?

- o Should policies be fashioned differently for clericals, professionals and managers?

3. Employment Effects

The key issues are:

- o What are the likely effects of the adoption of office automation on clericals, professionals and managers, and over what period of time?
- o What public and private sector policies should be considered for retraining, training and education?
- o What action should be taken to ensure a cooptimization of technology development and job redesign?

  This later issue is particularly important since computer-based technology is the least deterministic of all new technologies. (Walton and Vittori 1983) (Walton 1984), and further, the flexibility of the development of the technology and its interface with humans can provide an increasing number of opportunities for management/labor cooperation. Some of these options may minimize the adverse employment effects or even create compensating new employment in excess of the labor displaced.

4. The Diffusion and Development of New Technology

The last point raised in the previous section is relevant here. Additional policy concerns include:

- o Do we need to adopt policies to lessen labor's resistance to technological change and to encourage their commitment to participate in the new technology?

  > Walton (1984) argues that the criteria for technology development should include not only economic and technical factors, but also human and organizational criteria.

- o To what extent should federal procurement policies be utilized to simulate new technology?

- To what extent should the government be concerned with the emergence of a few dominant firms in the industry with a subsequent stratification of the technology?
- What opportunities or threats do foreign technologies present?
- To what extent will new generation "intelligent" computers with artificial intelligence capability, or other automated technology, make our concern with existing problems obsolete? For example: Perhaps there is no need to worry about dominance of the current technologies.

B. Instrumental Impacts

1. Technology Bargaining And Labor Law: The Scope Of An Employer's Duty To Bargain Over Technological Change*

This section examines the law regarding the question of whether management is obligated to bargain with labor over its decision to introduce technological change into the workplace. The National Labor Relations Act guarantees employees the right to bargain collectively with management; however, the Act does not specify with any particularity the subject matter or the timing of the employer's duty to bargain. The National Labor Relations Board and the federal courts have attempted to supply substance to the duty to bargain. At best, the decision-bargaining law derived from decisions of the Board and the courts is inconsistent and confused. Generally, the Board has shown a willingness to extend the duty to bargain over the introduction of technological change to the decision-making stage. The courts have tended to restrict the duty, requiring only that the employer bargain with labor over the effects of its unilateral decision. Recent decisions issued by the U.S.

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* Excerpted from a larger article in prepartion by Nicholas A. Ashford and Christine Ayers.

Supreme Court and the Board under the Reagan Administration clearly favor management's perogative to effect unilateral change in the workplace.

The labor law regarding the duty to bargain over technological change has developed in basically two different directions at the same time. Health and safety issues have been accorded great importance under the law; therefore, any change that impacts on health and safety is clearly a mandatory subject of bargaining. Although the law is not entirely clear on whether the duty arises at the decision or effects stage, a strong argument can be made that the law should be interpreted to mandate decision-bargaining. Threats to employment conditions and security, not involving health and safety, have not been accorded the same degree of importance as health and safety. Recent decisions have put forth a balancing test to weigh management's interests against those of labor in order to determine whether management has a duty to bargain over its decisions. The test, however, is vague so as to be nearly unworkable and is structured so as to tip in management's favor. In addition, the law regarding threats to employment conditions and security is much less clear than the law regarding health and safety. Since technological change can assume many forms and thus impact on the workplace in many different ways, the Board and the courts have tended to deal with its effects on a subject-by-subject, case-by-case basis. This has resulted in a great deal of inconsistency and confusion and provided virtually no guidance.

The difference in importance accorded health and safety issues from that accorded other threats to employment conditions and security as a result of technological change is incongruous. The rationale underlying the principle that decisions made regarding technological change are mandatory subjects of bargaining when health and safety issues are raised should apply equally to decisions made regarding that change which do not raise health and safety issues. Issues of job security impact just as significantly on the lives of workers. Arguably, those issues impact to an even greater degree in many instances. Health and safety issues impact on the individual lives of workers and perhaps their later offspring; however, issues of job security may well impact on the individual lives of workers, the lives of their families and all of the lives in an entire community. One need only consider what happened to small-town communities dependent on the automotive industry when the industry experienced major set-backs in the 1970's for an example of the devastating impact that the loss of jobs can exert.

A prevalent attitude in recent court and Board decisions is an almost paternalistic attitude that management is more capable than labor at making certain decisions and that labor's participation would only be a hindrance. However, there are examples of the collaborative efforts of management and labor in making corporate level decisions over the introduction of technological change. Although the examples are sometimes outside the collective bargaining contract, they demonstrate that labor's participation in the decisionmaking process is both feasible and desirable.

The National Labor Relations Act provided for collective bargaining for two reasons: to provide labor with more equal power against management, thereby protecting employees from destructive work conditions; and to provide the employees with a voice in decisions which affect their working lives, thereby providing a measure of industrial democracy. Through the NLRA, Congress expressed its desire to give American workers an opportunity to share in decisions that significantly affect their working lives. The Board and the federal courts have failed to afford American workers that opportunity. As technology continues to advance, and new and more sophisticated skills are introduced into the workplace, the impact on the workplace promises to be even greater. It is time that concerns surrounding health and safety as well as employment security be accorded the same degree of importance as management rights. Clearly, a legislative response to these problems is in order.

Technology bargaining refers to collective bargaining over the introduction of technological change into the workplace. Technological change can take numerous forms, some of the most common forms being: increased mechanization, the introduction of automation into the office or plant, the use of robotics, and the introduction of new raw materials or new power sources. The introduction of technological change may or may not have a negative impact on the work environment.

In spite of the nature of the impact of the technology, labor should have some control over existing technology which produces hazards in the workplace as well as some participation in the decisionmaking process through which management selects the technology that it will implement in the future.

There are not many cases dealing with the duty to bargain over technological change _per se_. The vast majority of cases stemming from technological change focus on individual problems that arise from the impact of the change, e.g., the various effects on the bargaining unit such as lay-offs or reclassification, transfers of operations, partial closings, health and safety problems, etc. As noted above, the complexity of the impact of technological change coupled with the piece-meal fashion in which the Board and the courts have approached the problems has resulted in a confused set of decisions. These decisions strongly favor management rights by limiting the duty to bargain to the effects of the technological change while according management unlimited discretion to make decisions regarding the introduction to the new technology. The position taken by the author is that, regardless of the nature of the impact of the technology, any decision to introduce technological change of any kind must be a mandatory subject of collective bargaining at the decision-making stage.

The impact of technological change on the work environment can take one of four basic forms:

1) More hazardous technology introduced with worker displacement;
2) More hazardous technology introduced with no worker displacement;
3) Safer technology introduced with worker displacement;
4) Safer technology introduced with no worker displacement;

Under current case law, an employer has a duty to bargain over the effects of technological change that results in any one of those four situations; however, an employer would appear to have a duty to bargain over the decision to introduce that change only in the first two situations in which health and safety issues are raised. Even then, although a strong case can be made that case law mandates decision-bargaining over health and safety issues, the situation is not absolutely clear on that point.

The first case is the most compelling, both from a legal and a policy point of view. The introduction of technology into the workplace that results both in job losses and in greater hazards to the remaining workers is clearly exerting tremendous impact on the terms and conditions of employment for those workers involved. The holding in the Gulf Power that health and safety issues are mandatory subjects of bargaining, coupled with the high priority accorded health and safety in the legislative history of the NLRA, strongly supports the proposition that considerations of health and safety override management prerogatives, and therefore, should be mandatory subjects of bargaining at the decision-making stage. However, under the current law, the issues surrounding displacement would not themselves be subjects of decision bargaining. Nevertheless, in this situation, since the health and safety issues would appear to give rise to a duty to decision bargain, the job displacement issues would then necessarily be included as subject of bargaining at the decision-making stage.

Examples of the situation where new technology could result in both increased hazards and job displacement may help to clarify the point that this enormous impact on workers compels that a duty to decision bargain be imposed on management. One example of this situation can occur in the chemical industry when a change is made from a batch process to a closed chemical process which is done under extremely high pressure.

This change in processes not only results in eliminating the need for as many workers, but it also poses greater dangers in the workplace in the form of an increased potential for explosions and toxic leaks. This situation also occurs with the introduction of high-speed cutting machinery which is used in various industries. This machinery is not only more efficient and requires less labor, but it can be extremely dangerous as well. This situation can arise in an office context as well as in the factory setting. The use of computers and word processors is a prime example of this situation. Computers and word processors are being used with ever increasing frequency in offices throughout the country. As a result, clerical workers are required to be better trained and more highly skilled, and certain lower-level clerical positions are being eliminated altogether. As time goes on, increased automation in the office will result in nearly fully-automated offices thereby eliminating the need for clerical staffs. Clearly, the increasing automation of offices is going to exert an astounding impact on the clerical workforce by virtually eliminating it in years to come. In addition to the job displacement problems caused by the use of office automation, the video display terminals (VDT's) found on computers and word processors are proving to be health hazards as well. Although some of the studies concerning the hazards of VDT's are as yet inconclusive, those studies do indicate that VDT's result in such problems as severe eye strain, back strain and exposure to low-level radiation emitted by VDT's, which some responsible scientists have postulated can produce birth defects and miscarriages in addition to eye cataracts and skin rashes. Although the studies may as yet be inconclusive and the injuries caused by VDT's may not be the same acute, immediate injuries often associated with hazards in the factory, they are of no less significance and thus should be accorded the same degree of priority in the collective bargaining process.

The job displacement problems in the examples given above impact upon the lives of the workers just as substantially as the health and safety problems. However, under current law, the issues surrounding job displacement will be mandatory subjects of decision-bargaining only if health and safety issues are also involved, assuming that one is able to successfully argue that precedent dictates that considerations of health and safety are mandatory subjects of decision bargaining.

If one is successful in making that argument, the outcome of the second situation, in which more hazardous technology is introduced with no displacement, will be the same as the outcome in the first situation since considerations of health and safety are the determinate factors in establishing the duty to decision bargain in both situations. An example of the second situation in the factory setting would be the simple substitution of one substance in the manufacturing process for another more toxic substance. Clearly, the union would have a substantial interest in protecting the health and safety of its members by participating in that decision. An example in the office context would again be the introduction of automation; however, the focus would be on the professional workforce rather than the clerical staff. The focus shifts in this second situation because the introduction of automation frequently results in less job displacement among the professional staff than the clerical staff. Since the professional staff will be utilizing the automation, however, they will be exposed to the same hazards as members of the clerical staff who also use it.

In the third and fourth situations, in which safer technology is introduced rather than more hazardous technology, one cannot rely as clearly on the high priority accorded health and safety issues as one could in the first two situations.

Nevertheless, even though safer technology is introduced, health and safety could well have been at issue during the decision-making process, in which case management should be obligated to bargain with labor at that time. An excellent example of a situation where safety was an issue in the decision to do so is the introduction of robotics to perform hazardous work previously performed by human workers. Although the use of robots to do hazardous work is admittedly a benefit to workers in one respect, it can exert a tremendous negative impact on their lives as well. The widespread use of robots can result in lay-offs and seniority problems and changes in the composition of the bargaining unit by making certain blue-collar jobs obsolete and requiring increased technical expertise. Compensation issues would be raised where the use of robots cuts down on the need for overtime and thus directly affects wages. These are but a few of the myriad ways in which the use of robots can impact on the workplace. A decision, such as the introduction of robots to do hazardous work, which exerts both a positive and a very negative impact on the lives of workers is properly a subject of decision bargaining. One of the purposes of collective bargaining is to provide workers with an opportunity to participate in decisions which profoundly affect their lives by proposing alternative ideas to management. Certainly, this is a situation in which workers would wish to propose alternatives and, perhaps, to make concessions to avoid complete automation of the process by using robots. Workers may often be even more concerned with job security than with the question of their own personal health and safety. Workers have had a long tradition of engaging in hazardous occupations (consider, e.g., coal miners) in order to support their families at the risk of their own lives. That is certainly not to say that management should not accord the highest priority to making the workplace as safe as possible for workers; that is rather to advocate that where various considerations surrounding health and safety must be weighed against those of job security, workers must be given a voice in those decisions.

A question surrounding the introduction of safer technology, regardless of whether it results in worker displacement or not, is whether the technology really is safer or whether the hazards are latent and as yet unknown. Management does not always possess complete and perfect information. Today many labor unions have become very sophisticated in their efforts to protect the health and safety of workers from hazards inherent in many technological advances. Often acting in concert with unions in other industrial markets abroad, American unions are expending substantial time, money and effort to researching and studying the effects on workers of exposure to various toxic substances, VDT's and the like. It is paternalistic and short-sighted to assume that management alone possesses all of the information necessary to make the most well-informed decisions concerning the health and safety of workers. Therefore, even where management intends in good faith to introduce safer technology, labor's participation in the decision-making process is required for a fully-informed decision.

The discussion thus far has focussed upon health and safety as a consideration in the decision-making process. Even if health and safety issues are not considerations in deciding to introduce technological change, the decision to introduce that change should be a mandatory subject of bargaining. The impact of technological change on job security can be even more far-reaching than the impact on health and safety. As noted earlier, health and safety tends to impact on individual workers and possibly their offspring. If new technology results in transfers of operations, partial plant closings or entire plant closings in a small community, that change impacts on the lives of workers, their families and the entire community. The effect can be devastating in economic, social and personal terms. Studies indicate that the physical and mental health of displaced workers often declines rapidly.

One study undertaken over a 13-year period indicated that the suicide rate among displaced workers is nearly thirty times the national average.

Those workers also display a higher than average incidence of hypertension and heart disease.

The above discussion should demonstrate that the impact of technological change can be grave and far-reaching. The law as currently written does accord high priority to issues of health and safety; however, technology can impact dramatically on workers' lives in many other ways. The union can adequately represent the interests and concerns of the workers involved and thereby mitigate the impact only through participation at the decision-making stage.

2. Collective Bargaining and Other Union Activity

In some of the Board and court decsions, great deference was accorded management's need for unfettered decision-making. In so deferring, the decisions cited such factors as management's need for speed, flexibility and secrecy in meeting business opportunities and exigencies as well as the futility of bargaining where there are no possible alternatives. Implicit in these comments is the assumption that labor can generally only hinder rather than advance the decision-making process. However, the introduction of technological change into the workplace is rarely done in an emergency situation requiring speed, flexibility or secrecy. In addition, the employer does not always necessarily have complete and perfect information concerning alternatives so as to know whether bargaining would be futile. Various experiences in employee participation in management are in direct contradiction to advocates of management's rights who argue that labor's participation is unworkable, or at best a hindrance.

Certain labor unions have been increasingly assuming a more collaborative role with management in the decision-making process. Unions have been participating in joint committees with management for some time. Many of these joint committees still play only a consultative role with management, exercising no real control; however, some unions are departing from a mere consultative role to assume a more active, collaborative role in the introduction of technology into the workplace. This has been done in the context of manufacturing, and is only beginning in office automation.

Although some of the new approaches to problems posed by technology are outside the collective bargaining contract, they demonstrate that labor's participation in the decision-making process is not only feasible, but often highly desirable. Joint participation offers the potential for labor to influence design features and plans of proposed technological change when decisions are being made, thereby offering greater potential for solving problems and fulfilling needs of both management and labor. The opportunities are especially great in office automation, where the technology is inherently more flexible than in manufacturing.

3. Worker Self-Help Actions

In addition to changes in the development of federal labor law and union activity, workers are likely to begin to undertake individual actions to prevent harm to themselves or to seek redress for damage traceable to office automation technologies. These self-help mechanisms include the exercise of the right to refuse hazardous work, products liability suits against the manufacturers of office automation equipment, the filing of discrimination complaints resulting from employer monitoring of both their productivity and their health status, and finally, the filing of workers' compensation claims.

The Right to Refuse Hazardous Work

The right to refuse hazardous work is guaranteed by the OSHA Act and the Labor Management Relations Act (LMRA) for all workers. However, the degrees of protection differ for union and non-union workers, and the reach of the OSHA and LMRA is different as well. (For a full discussion of the protections available for the exercise of the right to refuse hazardous work, see Ashford and Katz 1977).

The hazards posed by VDT's may be of the nature and severity protected by the right to refuse hazardous work. Perhaps the greatest protection would be afforded hazards to the reproductive system. Raising the consciousness of workers of reproductive hazards associated with new office technologies is likely to stimulate not only utilization of environmental protection statutes such as the Occupational Safety and Health Act and the Toxic Substance Control Act (Ashford and Caldart 1983), but also will encourage workers to seek medical removal protection during periods of pregnancy or during periods when reproductive activity is anticipated. In the event management is not sympathetic to health concerns, one may expect a great increase in the exercise of the right to refuse work. A key policy question is the extent to which this should be encouraged in order to leverage management towards taking a more protective posture.

Products Liability Suits

Paralleling the increase in products liability suits by workers against the manufacturers of toxic materials, can be expected a similar increase against the manufacturers of automated office equipment as soon as the evidence becomes more certain regarding the casual relationship between the use of the equipment and health effects such as permanent impairment of vision and reproductive system damage. A key policy question is to what extent this mechanism ought to be encouraged and to what extent activities to counter the increase in litigation should be discouraged.

Discrimination Complaints Resulting From Employer Monitoring

Monitoring the productivity of workers has become a major source of contention between management and labor. Up to now, unions have not been successful in discouraging the practice where management has sought to implement it. Workers may be expected to file unfair labor practices, arguing that such monitoring constitutes harassment and discriminatory treatment because the monitoring criteria, such as key strokes per hour, are not objective or informative criteria of productivity.

Recently, human monitoring for exposure to toxic substances has engendered much criticism because of the ill-founded tests used to establish health consequences and because the tests may be used to discriminate in an unacceptable way against employees who constitute a protected class such as one sex, the aged, the handicapped and certain races. (Ashford, Spadafor and Caldart 1984). Employers requiring medical examination for VDT operators must develop policies which are helpful and non-discriminatory in nature. Many unions have requested periodic medical examinations. Their implementation is likely to present problems reflecting conflicts of interest in their utilization.

In addition, issues of privacy and the tension between the need to keep records and to ensure confidentiality are important.

Workers Compensation

The workers compensation system is notoriously inadequate for handling worker claims for occupational disease (Ashford, Chapter 7, 1976). Nonetheless, workers are increasingly filing those claims for health damage allegedly traceable to the new office technologies. Policies for fair and equitable compensation need to be developed.

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Privacy and Security Issues in the Use of Personal Information About Clients and Customers on Micro and Personal Computers Used in Office Automation

Alan Westin, Columbia University

Lance Hoffman, George Washington University

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1. INTRODUCTION

1.1 Scope and Organization of this Report

This is the second of two reports for OTA by the Educational Fund for Individual Rights on "Privacy and Security Issues in the Use of Office Systems Technology."

Our first report, Privacy Issues in the Monitoring of Employee Work on VDTs in the Office Environment: Practices, Interests, and Policy Choices (1984), covered the growing use of office systems technology by employers to capture and record detailed records of employee performance at video display terminals (VDTs) and the policy issues raised when employers use these data to determine employee evaluations, pay, promotions, or discipline.

This second report covers "Client Privacy and Security Issues." We are concerned here with how office automation may be affecting the privacy and security of personal data that organizations collect and use to carry out their missions. Such data collection typically involves customers, licensees, patients, taxpayers, bank depositors, students, insurance-policy holders, credit applicants, members of voluntary associations, suspected or convicted criminals, welfare recipients, and many other groups in a "client" or "potential client" relationship to an organization.

As specified in our contract, we will be looking at the office-automation practices of business, government, and non-profit organizations. Where possible, we will be making comparisons of trends among these three organizational sectors. We will begin by examining privacy and security issues and standards as to EDP that had emerged by

1975-78. This baseline period was one in which EDP uses in organizations had become commonplace and a "first generation" of privacy and security rules and practices had been installed, but it was before the arrival of microprocessors and personal computers and their applications to office work had ushered in the "office automation" era.

We then describe the arrival of office systems technology in the late 1970s, and its explosive growth in 1982-85. We discuss the types of equipment, applications, and environments that have been created to apply micros and PCs to office work, and how this seems to be affecting the collection and use of client data. Our objective here is to identify situations where (1) office systems technology is essentially carrying forward pre-existing client data practices, with no significant changes in privacy and security exposures or balances; or (2) where office automation may have the potential to or already is altering practices as to client data in ways that raise new or significantly different privacy and security issues.

Based on this empirical report, we turn to the emerging policy issues as to privacy and security that organizations are -- or should be -- considering as they expand the uses of micros and PCs in their office environments. We include in this discussion descriptions of how selected business, government, and non-profit organizations are approaching the protection of privacy and security in offices making heavy use of micros and PCs.

From these profiles and other sources, we develop a checklist of "model organizational policies" that can be considered by managements in expanding their existing privacy and security policies to the OA environment, or in creating special policies for micro and PC uses.

Finally, we discuss whether there seems to be a need for social interventions -- regulation, legislation, judicial decisions, etc.-- to safeguard privacy and security interests in client data, or whether the growing expert and public attention to these questions and the developing responses of organizations seems adequate for the present.

1.2 Special Empirical Sources

This report utilizes our own experiences and contacts in the privacy and computer security areas, which spans 30 years of research by Alan F. Westin and 17 years by Lance Hoffman. We have reviewed the published literature on privacy and security in office-system applications that has appeared in computer, business, legal, and popular publications (see the Selected Bibliography for representative items), and have discussed expert perceptions of these issues with leading colleagues in the field.

For its main sources, however, this report draws upon four empirical activities that the Educational Fund has been conducting over the past two years into emerging privacy and security issues in office-system applications.

A. Field Study on "The Workplace Impact of Using VDTs in the Office." This two-year field study was conducted between April, 1982 and April, 1984 by the Educational Fund for Individual Rights, with partial funding from IBM, Hewlett-Packard, NCR, and other business firms interested in technology-society issues. The centerpiece of the study was a set of on-site studies of 110 organizations using VDTs extensively in office activities. Sixty percent of these organizations were business firms (in banking, insurance, manufacturing, utilities, media, consumer services, and other industries); 20% were federal, state, and local government agencies; and 20% were non-profit organizations (private universities and hospitals, foundations, labor unions, industry associations, civic groups, and others). Organizations participating in the study were guaranteed anonymity, unless express permission was obtained to identify an organization's experiences and actions. Issues of privacy and security were discussed with organizational staffs at about 60% of these sites, ranging across the three types of organizations, basically where those issues were relevant in the VDT applications we were examining at such organizations (such as confidential client data in law firms, hospitals, banks, or tax agencies.)

B. Supplementary Field Work at Our VDT Sites in Late 1984.
Since our field work for the VDT project was heavily concentrated in late 1982 and 1983, and we had learned that developments as to privacy and security consciousness were moving rapidly in 1984, we conducted supplementary telephone, mail, or on-site visits to 15 of the selection of 110 organizations in our original project. Our objective was to obtain detailed information on their privacy and security situations, as of late 1984. These activities were done with 8 business corporations and 7 federal agencies.

C. Inquiries Among Federal Agencies and Bureaus in Late 1984.
In the Fall of 1984, we addressed a letter to 75 federal departments, agencies, and bureaus, asking for descriptions of their current OA applications and the status of planning or policy-procedures formulation on issues of privacy and security in the use micros and PCs.

We received replies and documentation from 44 federal organizations (the list of respondents appears later in this report in section 4.2.1). We followed up these written replies with telephone interviews at 10 agencies with the most activity on privacy/security issues.

D. Survey of Computer Security Officers and Other Organizational Staffs Responsible for Privacy and Security. We prepared a survey instrument on privacy and security issues in office automation and administered this at the November, 1984 meeting of the Computer Security Institute. We received 301 completed questionnaires, from experts working primarily in large and medium sized business and government organizations. (Total attendance at the meeting was slightly over 1,000.) (Details on the respondents and the CSI membership appear later, in Section 4; the survey instrument is reprinted in the Appendix.)

Reports and monographs based on these empirical studies will be published by the Educational Fund throughout 1985-86. One article on privacy and security issues in office automation, drawn from early results of the VDT study, appeared in late 1983 in Computerworld.* However, most of our data about privacy and security in office automation are being provided to OTA before their publication anywhere else.

1.3 Analytic Framework and Definition of Key Terms

Since analysts from scientific, social-science, and legal disciplines all write about "privacy and security issues," it is not surprising that there is conflict or, at least, tension among the use of terms and concepts by these commentators. Without assuming that our judgments represent the best definitions, or that any one set of terms is likely to be

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* Alan F. Westin, "New Eyes on Privacy," Computerworld, November 28, 1983.

1.3.1 Defining Privacy, Confidentiality, and Security

In this report, we will be using the following terms and definitions:

privacy: the claim of individuals and groups to control access to their information by others, and the social and legal rules by which such claims are accepted (or rejected) in particular contexts.

confidentiality: the express or implied promise between an information provider and an information receiver that personal data provided will be used for specified purposes, and will not be used beyond such boundaries without the knowledge or consent of the provider.

security: as applied to personal information, the capacity of the data collector to safeguard personel data according to rules of confidentiality set by organizational policy or law. Popularly put, security involves an organization's ability to keep its promises of confidentiality.

> (A representative discussion by EDP experts of the relation between privacy and security considerations appears in Alexander Gaydasch, Jr.'s text, Principles of EDP Management (Reston, Va., Reston Publishing Co., 1982):
>
> "Privacy and security are related but not synonymous. Privacy addresses the use of data about individuals. Security is about the accidental or intentional theft, modification, or destruction of data. Although breaches of security may, in fact, compromise privacy, they may also be unrelated to privacy. For example, the theft of a mailing list stored on magnetic tape is a result of poor security and may compromise the privacy of individuals on that list. But the destruction of the tape, also a breach of security, does not necessarily have privacy ramifications.")

Some definitions of types of data will also be useful:

personal data (or information): data identified to a specific individual, and describing some characteristics of that person.

confidential data: personal data that has been collected and is being held under an express or implied promise of limited use and dissemination.

sensitive data: personal information whose disclosure beyond the purpose for which collected can reasonably be assumed to threaten embarrassing or harmful consequences to the individual involved.

More specifically, what we will be calling the "privacy issues" in office-system applications involve three components:

A. Data collection -- what personal information it is relevant, necessary, and socially-acceptable for an organization to collect to carry out its missions.

B. Confidentiality -- when should an organization record and preserve identified personal data, who should have access to it within the collecting organization, and under what circumstances can it be released outside the organization to third parties.

C. Subject notice and access -- when can the subject of data collection know that an identified record has been created about her or him, have the right to examine the record, and be able to challenge the accuracy, completeness or proper use being made of the record.

In popular usage, these three sets of issues are sometimes referred to as the "privacy," "confidentiality," and "due process" aspects of protecting personal data, especially in high-technology settings.

1.3.2 Office Automation Terminology

Terms such as "office automation," "end-user computing," or "small computer systems" are used widely to describe the use of micros and personal computers (PCs) to conduct office functions. Even before the flowering of the "automated office" concept in the late 1970s and early 80s, there was a relatively high degree of automation in some offices, which tied early text editors, terminals, and large mainframe computers together. With the arrival of microchip technology, the computers to provide word processing and professional/executive work stations became smaller and more likely to "stand alone," or to have stand-alone as well as "connectability" features.

In this report, we will use either the term office automation or office-system applications to refer to two primary uses of information technology in office and customer-service activities:

A. Stand-alone micros that provide computing capabilities for uses such as dedicated word processing or scientific and professional activities.

B. Personal computers (PCs) with stand-alone capabilities for professional and managerial uses but are also capable of being connected to mainframes or multi-terminal systems.

(For the evolution of these machines, see pages 18-20.)

Our definition has been chosen to differentiate current OA issues from the privacy and security problems involved in dumb terminals connected to mainframes, which have been present in EDP systems for two decades. However, it deserves mention at the start that this is probably a transient distinction, useful for the period we are presently in but likely to disappear -- for policy purposes -- as offices tie EDP, OA, and telecommunication features into highly-integrated information systems, and in which multi-purpose desk terminals allow many users to do both voice and data processing, stand-alone computing, and mainframe and inter-organizational communication.

2. BEFORE OA: THE BASELINE IN 1975-78

2.1 The Impact of EDP on Organizational Information Practices and Privacy Interests

Protection of privacy in record-keeping systems (and security measures to accomplish such protection) is a concern of American society that moved from the Constitutional era of quill pen and copybook through the invention of telegraph, telephone, typewriter, microphone, duplicating machine, large-scale manual filing systems, teletype, electric accounting machinery (EAM) and first, second, and third-generation computers.

From a privacy standpoint, the key impacts of EDP and telecommunication systems (1960-1975) were as follows:

A. It was now very much cheaper and easier for organizations to collect data about clients and customers, and to expand the critical-information sets on which to base organizational judgments about people. As software became more flexible, mass-memory storage much cheaper, and data conversion methods more rapid and economical, the "early constraints" on EDP system data collection and use were dramatically lowered.

B. It was now much cheaper and easier for organizations to exchange or share data about individuals, primarily among organizations within the same industry or field (where such exchanges were traditional) but also in many inter-sector networks spawned by complex society and now made feasible by telecommunications and compatible data systems.

C. Because of the growing reliance by large private and public organizations on record-based data to make judgments about people's rights, benefits, and opportunities, and a dramatic lessening of face-to-face contacts, computerized data systems became increasingly central to the lives of virtually everyone in American society -- rich and poor, celebrity and shoe clerk, black and white, young or old, critics or celebrants of the "system."

D. Given this reliance, data systems about which individual data subjects were unaware, or which did not afford subjects rights of notice and challenge, or which had high error rates, represented serious threats to fair decision-making in a "records-based" society.

E. Because these computer-stimulated trends arrived in the 1960s and early 1970s -- a time of dramatic changes in social and political values and in individual-organizational relationships -- issues of "privacy and databanks" became the focus for a set of new, powerful and widely-held social demands. These insisted that organizations should justify the personal data they collected; assure that those data were used solely for the purpose given; and not give these data further circulation unless consented to or socially-approved; and that a new system of notice and challenge be provided to assure due process rights to data subjects.

F. The heart of this "privacy position" was not that the computer had created intrusive or improper data collection and use, but that EDP would preserve and extend improper decision-making practices as to race, sex, age, lifestyle, political belief, sexual orientation, and other aspects of individual identity about which pre-1960s social values had embedded critical guideposts in manual record systems. If such "record judgments" were now applied with the expanded efficiency and awesome processing capabilities of computer systems, the "old values" of the 1945-1960 era would rule from the grave, and dominate the lives of a whole new generation that was fighting in the streets, at the polls, and in the courts to win new rights of equality, liberty, and due process.

G. By the middle to late 1970s, repeated public opinion surveys showed that about two out of three Americans were concerned with organizational threats to their privacy interests; were especially concerned about the use of computers by business and government to process sensitive personal data about them; and favored both enactment of laws and promulgation of organizational policies to protect fair information practices concepts. Analysis of these data (and of interest-group materials) showed a high agreement between liberals and conservatives on these issues, and also broad agreement among various demographic categories (age, sex, race, education, income, etc.).

Summing up this capsule overview, we can see that EDP systems brought significant new power to user organizations. It was possible for personal client data to be:

- collected and recorded more easily
- analyzed, compared, and collated more fully
- distributed to or made accessible to more people within the collecting organization
- amalgamated with data on individuals obtained from other organizations having computerized record systems
- disseminated more widely, both in inter-organizational networks and is response to specific demands from other organizations

These capacities made it possible to provide more customized and personal services by business and government. But they also raised the possibility of computer systems breaking down the vital compartments and boundaries that helped keep client information confidential, and that is what the privacy-and-databanks debate of the 1970s was about.

There were also three basic aspects of internal organizational control in the EDP era that provided the framework for carrying out new privacy rules:

- in the EDP era, small staffs of EDP professionals ran the data centers and controlled access to automated files.
- the users of such systems were EDP professionals or a small segment of organizational work forces trained in data confidentiality and security principles and procedures.
- there were centralized security procedures of access and audit that could help insure that terminal users followed the legal and organizational rules.

2.2 The Adoption of New Privacy Protection Laws and Organizational Codes, 1970-1978

The response of American society and of other democratic nations to both the social-change aspects of privacy protection and the computer-based handling of personal data by organizations has been well told, in detail, from a variety of ideological perspectives.[1] (One recent review of privacy developments in the first two decades of EDP development, by Alan F. Westin, has been included in the Appendix, to avoid the necessity of retelling the story in detail here.)

By the late 1970s, a detailed latticework of laws, regulations, organizational policies, and social expectations regarding privacy protection in EDP systems had been put into place in the United States. In broad terms, these measures followed three main channels:

- Codes of "fair information practices" were developed by law or organizational standards to govern the collection, use, and release of personal data on clients and customers, and to make this process visible and accountable to both data subjects and the public. In this stream of response would be the Federal Privacy Act of 1974; the Federal Freedom of Information Act Amendments of 1974, and similar "jurisdiction-wide" statutes in twelve states.

- Laws and regulations were promulgated to deal with privacy balances and rules in particular fields of organizational record-keeping -- banking, insurance, health care, education, credit-reporting, employment, law-enforcement, etc. At the statutory level, this is examplified by the Federal Fair Credit Reporting Act of 1970, Family and Educational Privacy Amendments of 1974, and Financial Right to Privacy Act of 1978; and by state medical, banking, insurance, and employee privacy legislation; and by the so-called LEAA (Law Enforcement Assistance Act) Regulations for automated criminal history systems in state government.

- In furtherance of such laws, and in many areas where no legislation had yet been enacted, many private and public organizations developed "privacy codes" or "fair information practices standards" to govern their own handling of client or employee personal data. The motives for such action were a blend of concern to meet legitimate privacy concerns of clients and employees; the desire to help avoid detailed legal regulation; and the judgment -- widely shared among leading organizations in most sectors -- that fair-information-practices rules had a generally positive effect on accuracy, completeness, and timeliness in the management of automated data systems, and could be initiated without heavy costs in money or efficiency.

By the time that office automation began to add new dimensions to the handling of personal data in office work, in the late 1970s and early 1980s, several aspects of the way that the EDP-and-privacy issue had been handled had become apparent.

- Though much privacy-protection action had been taken, there were still debates among privacy-advocates as to whether the data collection and the confidentiality aspects of privacy had been adequately dealt with, in what was coming to be called the "first generation" of privacy-protection measures. Supporters of the first-generation measures said that the emphasis on notice, challenge, and due process rights of data subjects, and workable procedures for strengthening confidentiality rules, were the appropriate and majority-supported ways to safeguard legitimate privacy rights. Critics said that there had been too few limitations on what was appropriate to collect about people's transactions and activities in many sectors of business and government life, and that merging data from different organizations about the same individual (e.g., in computer matching programs) threatened to shatter basic confidentiality standards.

- There was also debate among informed observers and in the media about whether we had created the necessary machinery with which to enforce privacy rights, and to identify newly emerging problems of computer use by organizations that might call for additional legal interventions. Examples of this debate involved the performance of the Office of Management and Budget in administering the Federal Privacy Act of 1974, the absence of a Privacy Commission or Privacy Ombudsman in the U.S. (as in many European countries and Canada), and the generally permissive position of the U.S. Supreme Court in matters of data collection by business and government organizations.

- As new applications of EDP and telecommunication systems developed, there were debates over whether these were covered by "first generation" privacy measures. Examples of debate here involved electronic funds transfer systems (EFT), two-way cable-TV systems, and Postal Service electronic-mail projects.

- There was also concern on privacy grounds that plans for very large and sophisticated ADP systems by federal agencies, in replacements for antiquated 2nd and 3rd generation systems, might be going forward without sufficient attention to new privacy risks. In this category would be debates over the proposed FBI "Triple I" system for processing criminal history records, and plans by agencies such as the IRS, Social Security, Secret Service, and VA.

These last observations suggest that office automation is unfolding at a moment in American society when (1) an extensive set of privacy protections in handling personal data, in manual and EDP systems, has been put into place; (2) debate continues as to whether these protections are adequate in scope and are being vigorously administered; and (3) new issues of privacy are unfolding and will have to be settled as new EDP and telecommunication systems prompt new organizational applications and networks, and as older agencies move their record systems into state-of-the-art ADP environments.

At the same time, the 1978-1985 period is one in which American public opinion and electoral trends indicate rising concern over apprehension and conviction of criminals, detection of fraud and abuse in public social-welfare programs, and limitation of regulatory "intrusion" by government into business and individual affairs (even in the name of "protecting privacy.") While concern for preserving privacy remains high in recent surveys (1983), there are clearly new social attitudes in the current era, compared to the high-point of the "post-Watergate" and "post Vietnam" atmospheres of 1974-78.

Finally, it is useful to note that as of 1975-78, institutionalization of privacy policies and procedures within organizations, and significant educational efforts with organizational personnel, were still in their early stages. Passage of the Federal Privacy Act and the FOIA

Amendments in 1974 set federal agencies into compliance activities, and some effort had taken place by 1978. State law enforcement agencies had begun compliance with the "LEAA regs" by 1978, and a few states had passed Fair Information Practices Law by 1978. However, experience in the private sector with new data privacy laws was limited before 1978 primarily to the Fair Credit Reporting Act, covering practices of credit-reporting agencies and the credit-grantors, employers, and insurers who used their services. Public and private schools and universities began confidentiality and subject-access compliance with the Buckley Amendment in 1974. While a few private corporations such as IBM, Bank of America, and Control Data had developed employee privacy codes in the early to middle 1970s, they were a handful among the 10,000 large private employers in the U.S.

It was really not until after the Report of the U.S. Privacy Protection Study Commission in July 1977 (urging new laws and voluntary codes in the private sector), and passage of new privacy legislation in 1978-82 (Federal Financial Right to Privacy Act, protecting bank depositors, and state laws on insurance, employment, medical, educational, and consumer privacy) that broad institutionalization of privacy rules took place inside major private-sector organizations. Such institutionalization was becoming widespread in manual and EDP activities within organizations, and regulatory/judicial enforcement was also becoming the norm, at just the point that office automation applications were taken up in the public and private sectors in the early 1980s.

2.3 The EDP Security Situation in the Mid-Seventies

Computer-system security measures originally evolved from manual techniques for physical security carried over from the electronic accounting machine days of the 1950s. Usually physical security (locking up sensitive card decks and tapes) was the prime technique. As first and second generation batch computer systems were introduced and then remote terminals and teleprocessing arrived with the third generation, computer security techniques became more technological and sophisticated. Passwords were used to restrict access to information based upon a user's or terminal's privileges or on the type of function being performed. A few systems used cryptography, especially those involved in national defense. Some systems provided other mechanisms to assist proper authorization, most notably the hardware rings provided by the GE/Honeywell machines of the late 1960s and early 1970s. But the general opinion among technologists was that it was tough enough to get a program to run at all on a given hardware system, and security took a back seat to other design criteria such as correctness, speed, cost, and utility.

At the same time, computer and software designers were becoming sensitive to security problems in computer systems, partially due to the public concerns over privacy noted in the previous section, and partially due to an outpouring of papers on security. Examples were Petersen and Turn's "Systems Implications of Information Privacy" and Ware's "Security and Privacy in Computer Systems" in the Proceedings of the 1967 Spring Joint Computer Conference, and Hoffman's "Computers and Privacy: A Survey" in the then-fledgling ACM Computing Surveys in 1969.

2.3 Security and Organizational Uses of Data

As third generation systems became more common in industry and government, the use of data within organizations changed and networks were built up; rather than using one computer center, one or more systems could be accessed via user terminals. Indeed, commercial time-sharing networks grew to service the needs of organizations without the resources or inclination to start their own networks. Minicomputers appeared, complete with enough secondary storage capability to justify downloading some data bases to them. In contrast to today's microcomputer systems, minis were generally still purchased and operated by data processing organizations within a larger organization.

At the same time, the public evidenced a growing awareness of unpleasant side effects of the new computer systems, particularly in the areas of potential loss of privacy and in fairness or due process. Thus the security of computer systems took on added importance and led to additional safeguards such as logs (journaling) of important operations and more specific policies with respect to computer security, as means to carry out confidentiality and accountability measurements of privacy laws.

However, one must keep in mind that in the great majority of organizations, the most sensitive narrative information was still not computerized at this time; it remained on paper in "manual files." Thus, most problems involving personal data in the late 1970s still were associated with manual records, and this remains the situation in most offices today as well.

2.4 Professionalization of EDP Security and Legitimization at Top Management Level

"Data protection" began to emerge as a concept both here and in some European countries in the early 1970s. This umbrella term covered privacy, security, transborder data flow, and similar issues. With its emergence and the passage of Privacy Acts and Freedom of Information Laws, a small group of specialists on privacy and on freedom of information appeared in the federal and state governments. At the same time, EDP security as a separate discipline and as a separate line item in organizational budgets was very slowly emerging. Up to this point, there was no significant professional society involvement with privacy and security. No periodical journals devoted to computer security or privacy yet existed, and the first computer security conference had just taken place, organized by the then brand new Computer Security Institute.

2.5 Emerging Security Tools

By the end of the pre-OA period, a literature, both in the law and in computer science, had started to build up and a handful of leading universities had put courses on privacy and security in place. However, the advent of commercial products to enhance computer security (such as the ACF2 access control package for IBM mainframes and various vendors' versions of the National Bureau of Standards Data Encryption Standard) had not yet been introduced. Some leading manufacturers such as IBM and Honeywell were starting to take seriously the task of educating their users with respect to these issues, and an advance guard of computer practitioners were actually becoming knowledgeable and comfortable with computer security issues. Most general guidance for government users in the form of National Bureau of Standards publications related to computer security wouldn't appear until after the Privacy Act became effective at the end of this period. "Second-generation" technological security issues (kernels, certification, etc.) were just starting to be investigated. The federal government in 1978 was a few years away from issuing regulations mandating computer security measures in many federal systems.

At this time, the closest thing to a commercially available microcomputer was often sold as a kit similar to those used for model airplanes. These at first did not support higher-level programming languages like Basic, and certainly had no software packages like LOTUS 1-2-3 or other spreadsheets available. Data and program entry for these often was done with manual switches, just as it was on computers developed almost thirty years earlier at the end of World War II.

Many offices did not use computers. Those that did often contracted out their important applications, such as financial transactions, to service bureaus. (Today, a user can obtain almost the same computing power on large microcomputer systems at a fraction of the cost.) We would estimate that at most 5% of organizations had a program of computer security which involved anything more than backup or contingency plans in the case of natural disaster.

3. THE ARRIVAL AND PROLIFERATION OF OFFICE AUTOMATION

3.1 The Contours of OA, 1978-1985

Three developments in OA are central to our focus on privacy and security issues:

- The arrival of stand-alone word processors and text editors in the late 1970s, perceived as higher-order typing instruments and generally procured and controlled by office-administration staffs or user departments.

- The move to widespread professional micros, now available at prices and with features that allowed organizations to procure them for stand-alone work and not only when linkage to on-line mainframes and minis was involved. Generally, these machines were ordered by user departments, though often with EDP-Department guidance.
- The explosion of PCs in the early 1980s, for professional, sales, and executive use as stand-alone computing devices, and increasing linkage of such PCs to minis and mainframes. PCs in most organizations were ordered by individuals or by user departments, with limited guidance or control in 1981-84 by EDP departments or central Administrative Services functions.

As each of these types of terminal/software devices arrived, they fostered new ways of carrying out office work.

- Word processors led to automated letter and document editing and final-copy production; storage of completed or in-process documents; integration of text and graphics by word processor operators; presentation graphics; and related activities.
- Professional micros led to creation of personal databases; calendar and message functions; and unsupervised or unlogged analytic activity..
- PCs allowed most of the activity done on professional micros and added -- for managers and executives -- such activities as electronic mail and message systems; telephone call management; spreadsheet and related financial analysis; and similar functions.

By 1984-85, each of these three original types of stand-alone terminal/software machinery was beginning to be linked to minis and mainframes. With this possibility came access to central or distributed databases; the ability to download from or upload data to mainframes; and interconnection of micros and PCs with each other, within units or across units of the organization, independent of mainframe controls.

By 1985, 12-15 million terminals were estimated to be in place in American office (and some factory) workplaces.* We have not seen any figures on how many of these are EDP-oriented "dumb" terminals or terminal-

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* This estimate was independently supplied to us by CBEMA and IBM.

and-telecommunication systems used for customer-service and how many are the stand-alone micros and PCs whose effects we are analyzing in this report. However, if we take (1) word processors used for secretarial and para-professional activity; (2) professional/technical workstations; and (3) PCs used in the office, we believe we are talking about at least 5-7 million terminals in early 1985.*

3.2 Major Effects on Office Information Uses

The immediate impact of these office-system developments on organizational life has been well described by William Murray of IBM, from the perspective of the DP managers:

> "First, input and output became cheaper. The terminal appeared; key entry and some output left the controlled environment and moved to the users' work space. However, control was still centralized and the data was still in the safe environment.
>
> "Now intelligence and storage are becoming cheaper and they too are moving into the user's office. With this new proliferation and distribution of hardware, there is a re-distribution of data. Copies of the data which has been centralized for the past twenty years are now appearing in that distributed storage. Office data, which has resisted computerization till now, is being sucked into these systems. As storage becomes cheaper and cheaper, more and more copies are made. One of the economic motives for many people to share a single copy is diminishing.
>
> "However, this is not the planned orderly process that we thought we foresaw five years ago and which we called 'Distributed Data Processing.' This is not a process initiated by data processing management. They are not making the plans or decisions. They are not deciding what things will be done or where. They are not choosing or controlling the hardware. They are not leading but following.
>
> "This is not the host-controlled process that we expected. Applications are not being written centrally and distributed to host-controlled distributed processors. The computers in question are not centrally initialized and operated....
>
> "The process that I am talking about is spontaneous, not planned. It is initiated by users, not dp. It is motivated by local economics, not the organization's plan....

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* Estimate supplied by CBEMA, Dr. Charlotte LeGates, 1984.

> "In IBM we now have a world-wide network of more than 1500 mainframes and 200,000 terminals. Any user at any terminal can send a message or a file to any other user. A user at any of those more than 200,000 terminals can connect to any application in any of those 1500 systems. Programs and even entire applications spread spontaneously through the network, usually without management direction or intent and often without management understanding or knowledge. Employees can access the network from their homes. Some vendors and contractors use it... dp management did not plan it. They bought it and built it but they were just as surprised as anyone else when they saw what 'God had wrought.'"

This characterization by Murray serves as a good introduction to an inventory of key differences between EDP and OA handling of client data in organizations, with particular attention to potential privacy and security implications. We have grouped these into differences that would seem to be long-term characteristics of OA systems and those that are currently present but may turn out to be transient characteristics, or ones that could be remedied by direct policy measures.

Probable long-term characteristics of OA, different from EDP

More finished and refined data in OA systems. In most organizations, word processors contain finished correspondence, memoranda, documents, charts, and reports. Depending on the organization and the unit using micros, these stored materials may contain sensitive personal data on clients, proprietary data of the organization, information confidential to particular employees or units, and sensitive data in terms of regulatory/legal responsibilities. While much raw data and some reports of this kind reside in mainframe storage, the data in word processors or professional/executive micros is generally more complete, narrative, and revealing than what resides in central storage.

OA data more readily accessible to casual and non-DP unskilled interlopers. An interloper, whether another employee, a visitor, or an intruder, who seeks to extract sensitive data from the mainframe software codes, not to mention how to deal with special security protections that most organizations have built into mainframe databases. As a result of the "user-friendly" instruction systems for most micros and PCs, interlopers unskilled in DP are more able to call up data on screens, print out documents, or copy diskettes than they would be in EDP systems.

Micros and PCs and their data-storage media are often mobile, within and outside the organization's premises. The traditional dumb terminals connected to mainframes are known to the system, their uses are usually logged or monitored (with the degree depending on the sensitivity of data involved), and they do not usually move around at the end-user's choice. Micros and PCs and their diskettes are increasingly portable, able to be moved around within organizational offices without central control or notice, and can be taken home or on trips for organizational business.

Micros can be used by their operators to attack the security of mainframe and mini data, and obtain confidential client data improperly. While this could and can be done from any terminals, including those developed for mainframe use, the widespread distribution of micros and PCs and the proliferation of terminals generally in organizations, plus easy-to-use software instructions, is expanding the number of persons within organizations that have a tool with which to probe password security, attempt unauthorized entry, or alter confidential data.

Unpredictable individual and group behavior of OA end users. Moving from manual, electric, and EDP-systems in offices into integrated voice-data and integrated OA-EDP-telecommunication networks creates significant new access to data, new computing power in individual hands, and new communication channels inside complex, bureaucratic organizations. There is simply no way to predict with any assurance how office employees and managers will use these powerful new capacities. As a general rule of thumb in human and organizational history, it is safe to assume that drives for power, wealth, personal advancement, and service to ideological causes will be strong motivators for at least some organizational employees and managers using micros and PCs. To project the basic weaknesses of human nature onto the new settings of office-system technology is an appropriate exercise in vulnerability analysis, even though there may be countervailing strengths in human nature that can be harnessed once dangers are perceived. In short, there will be some conduct by insiders and outsiders arising out of the new opportunities in micro and PC use that are certain to pose risks, and this has to be the perspective with which privacy and security risks are assessed.

Present differences, but subject to change from experience or policy interventions

Decentralized authorization and introduction: in most OA applications, individual end users or user departments decide what hardware and software to purchase, who will have the machines, and what uses will be made of them. In EDP systems, this would have been a decision made by the EDP Department, EDP-Users Committee, or a Senior Vice President for Administration.

Low-security or no-security physical environment: except for military, diplomatic, and a few private-sector settings that operate in "high-sensitive data" modes, most organizations have put micros and PCs onto desks in working areas that are open to passing fellow-workers, service personnel, invited visitors, or even the general public. Storage of diskettes, location of printers, and other peripheral equipment is also usually in insecure environments. However, theft of micro and PC equipment has led some organizations to lock doors and entryways that were previously not secured.

OA end-users are less sophisticated in privacy and security matters than EDP users. While 10% of organizational personnel may have been using terminals in the middle 1970s, with mainframe and mini computers, either in EDP units or as EDP-trained operators in user departments, between 25-35% of personnel in large organizations are probably using micros or PCs today, and use is proliferating rapidly. * Typically, these end-users have not been trained in how use of their micros can raise privacy issues or compromise security protections.

Some OA applications are creating uncontrolled channels of data communication within organizations. Electronic message systems, bulletin boards, and micro networks often allow end users to send messages to everyone using these systems, or to create their own distribution lists. As a result, messages with confidential data can move around either anonymously, or without control for their confidential aspects.

Many micros and PCs in organizations are now able to download or upload data from mainframes and minis, including confidential client information. As organizations connect their micros and PCs to their central or distributed databases, so that end users within the organization can reach such databases for analytic purposes, controls over alteration of data or unauthorized access become critical for privacy and security purposes.

Little or no terminal hardware security or software security protections in place. Because of the ways that word processors and micros entered office work, there was neither a perceived necessity or an assumed "market demand" for built-in terminal hardware protections such as locks on the machines. Similarly, in buying or designing software for office systems, organizations have generally not specified audit trails, cryptographic protections, and other measures that could have been installed -- though clearly at added costs -- in bringing such office systems into operations.

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* Estimate from the Diebold Group, 1983.

4. Privacy and Security Issues in OA

We move now to an analysis of privacy and security issues in using micros and PCs to process personal data of clients in office work. First, we look at potential vulnerabilities, drawing on the characteristics of micro/PC operations we have just outlined. Our discussion is based on our interviews with organizational managers and staffs, our survey of computer security personnel, conversations with privacy experts, and our review of published materials. Secondly, we discuss how these potential privacy and security risks are currently being handled by organizations, and provide estimates of the extent of actual breaches of privacy and security in these organizations, based primarily on our field work and CSI survey.

4.1 Potential Vulnerabilities in OA Use

Potential vulnerabilities to client data in OA can either be new exposures created by micro/PC use or can be extensions or alterations of known exposures from manual and EDP record keeping. Examining such potential vulnerabilities in OA follows the studies of EDP systems impact done by the National Academy of Sciences in 1969-1972; the HEW Advisory Committee in 1972-1973; and the U.S. Privacy Protection Study Commission in 1975-1977. Hopefully, the examination of potential OA vulnerabilities can benefit from the experiences with risk-assessment and reality-testing that were developed in the 1969-1977 EDP studies, as well as the practical experiences gained over the past decade in administering the standards promulgated for client data as the "first generation" of privacy and security rules.

4.2 POTENTIAL PRIVACY EXPOSURES

Using our three sectors of privacy concern, we list here types of potential end user conduct that could violate existing privacy standards as to client data. (We will give examples of such conduct or scenarios of possible actions in the next section.)

A. Data collection

One major characteristic of micros and PCs is that they permit -- indeed, they are marketed to stimulate -- the creation of any files or databases that the end user wishes to maintain. "Computing power to the end user" is the watchword of the microrevolution. However, micro users may, either without awareness of or in deliberate disregard of privacy rules, put personal client information into "their" files that violate laws, regulations, organizational rules, or ethical guidelines. If there is no auditing or physical inspections of end user files, managements may be unaware of such conduct, and suffer legal or reputational sanctions as a result.

B. Confidentiality

Where micros and PCs are connected to central or distributed databases, end users may take client information from those files and merge it with other client data in ways that violate privacy standards. Where micros and PCs are used in electronic mail and message systems, end users may send confidential client information inadvertently to those not entitled to have it, especially through use of "automatic" distribution lists.

C. Subject notice and access

Where end users create files improperly or record confidential data they should not have accessed, failure to inform clients that such files have been created and might be used in making decisions about clients could be a violation of several basic privacy laws (the Federal Privacy Act, state fair information practices acts, Fair Credit Reporting Act, state insurance privacy acts, etc.) as well as the organizational rules of many banks, insurance firms, brokerage houses, medical facilities, educational institutions, and other private organizations. And, failure to provide opportunities for individual clients or potential clients to examine and challenge such micro-based files would be an equal violation of such laws or rules.

4.3 POTENTIAL SECURITY VULNERABILITIES

Potential security risks to sensitive client data in micro and PC use fall under seven main headings:

A. Lack of clear organizational policy identifying sensitive information in OA systems

The basic requirement for sound security is to identify information that is sensitive and needs special protection. (Any effort to protect "all" information in ordinary business or government organizations would be too costly and virtually paralyze organizational programs.)

B. Failure to provide adequate physical-location security for machines and storage media

Most micros and PCs are not kept in locked rooms and diskettes are often not kept in locked cabinets or desks. Easy physical access to such micro equipment poses real security risks; for example, diskettes can be copied on another machine, on or off the premises.

C. Failure to have key locks on terminals

Most micros and PCs do not have key locks that control on-off functions of these machines, enabling third parties to activate the machines and use them.

D. Weaknesses in password systems governing access to central databases from micros

Micros and PCs connected to mainframes in many organizations suffer from the same security problems as dumb terminals; end users are casual about writing down or telling their passwords to others, and unauthorized persons may use someone's micro to access such confidential client data.

E. Creating logs or journaling is often not done on office systems of connected micros

Though central databases of confidential client data are often provided with audit trails, transaction logs, or journaling capabilities, these techniques are often not used when groups of 10, 20, or 50 micros are connected to minicomputers or, through them, to mainframe files.

F. Most office-based micro systems do not record efforts to penetrate their security

In mainframe systems, a log procedure that records access (or attempted access) to restricted files is usually provided to purchasers or is developed by the EDP staff. It is rare to either provide this with micros or for a logging procedure to be developed as part of OA installations. As a result, most micro-based systems do not have logs that warn security officers that efforts to enter restricted files improperly have been attempted.

G. Absence of either security education for end users or auditing of end user practices

Even if sensitive information was identified, security measures were adopted, and records were kept of efforts to access databases improperly from micros, most experts would agree that security of sensitive client data also requires end users having clear education on security policies and procedures, and that sufficient inspections or auditing are carried out to learn whether security policies were being followed by end users. Neither of these activities were commonplace in OA environments.

4.4 REPORT ON CONCERNS, EXPERIENCES AND RESPONSES OF SELECTED OA USERS

4.4.1 Introduction: Recap of Empirical Sources

It is useful to add some additional details to the description of our empirical sources presented earlier in Section 1.2.

A. VDT Site Visits and Late 1984 Updates

The 70 organizations whose privacy and security policies we looked at were part of a 110-organization pool. These OA users were not a representative sample of industry or government. They were selected on the basis of two characteristics: (1) they had strong reputations in computer and business circles as active, advanced, and unusually skillful users of office systems technology; and (2) they also had reputations in the personnel and organizational-management community as leaders in dealing creatively and successfully with the employee-relations and organizational-change aspects of using new information technologies. The 15 organizations contacted in the last quarter of 1984, to update our snapshot of privacy and security developments, were a representative group of the total organizations we had visited earlier. Under our selection procedures and based on our site visits, we do not consider them to be "vanguard" of organizations as far as privacy and security policies are concerned.

B. Federal Agency Inquiry

We addressed a letter of inquiry to 78 federal agencies, bureaus, or departments in September of 1984, using a list of ADP executives in these agencies supplied to us by OTA. As of December 31, 1984, 44 agencies had responded by letter and accompanying documentation. We conducted follow-up telephone interviews with 10 of these reporting especially significant activity relating to private and security issues. The list of responding agencies appears in Figure 1.

Figure 1

FEDERAL AGENCY RESPONSES TO PROJECT LETTER ON PRIVACY AND SECURITY IN OFFICE AUTOMATION (44)

Adv. Comm. on Historic Preservation
American Battle Monuments Commission
Bureau of Labor Statistics
Commission for Purchase from the Blind
Commission on Fine Arts
Commodity Futures Trading Commission
Department of Agriculture
Department of the Army
Department of Commerce
Department of Defense
Department of Energy
Department of Health and Human Services
Department of Housing and Urban Development
Department of the Interior
Department of Justice
Department of Labor
Department of Transportation
Department of Treasury
Environment Protection Agency
Equal Employment Opportunity Commission (EEOC)
Executive Office of President
Farm Credit Administration
Federal Communications Commission
Federal Deposit Insurance Corp.
Federal Energy Regulatory Commission
Federal Reserve Board
Foreign Claims Settlement Commission
General Services Administration
National Aeronautics and Space Administration (NASA)
National Bureau of Standards
National Capitol Planning Commission
National Commission on Libraries and Information Service
National Endowment for the Arts
National Science Foundation
National Transportation Safety Board
Office of Personnel Management
Panama Canal Commission
Railroad Retirement Board
Selective Service System
Small Business Administration
Tennessee Valley Authority (TVA)
U.S. Information Agency
U.S. Merit Systems Protection Board
Veterans Administration

In addition, the Department of Navy's response was lost in the mail and is being resent; Social Security Administration will have its response in by mid-January.

C. Survey of Computer Security Officers in Organizations, November, 1984

Approximately 1,000 persons attended the November, 1984 Computer Security Institute; 301 returned our survey, for a 30% response rate. These respondents and the organizations they work for had the following characteristics that we should note at the outset.

- 58% of respondents serve as data security officers; 18% are in DP management; and 24% serve in auditing or general management.
- 67% work in private business firms; 25% for government agencies; and 8% for non-profit organizations or as independent consultants. Federal civilian and military-agency employees were the predominant government attendees.
- 68% of the organizations these respondents work for have over 1,000 employees. (Actually, we estimate that 80% probably work in such large-scale organizations, since we allowed respondents to answer for the sub-unit of the organization they worked for, and 19% of the total respondents gave the number of employees for their sub-unit.)
- 52% report they have over 500 terminals in use. However, only 28% report that more than half of these are being used in "office applications."
- In terms of occupational groups using terminals, 55% of these organizations report that more than half of their secretaries have their own VDT or share one for regular work; 47% report more than half their professional and technical workers have VDTs; 34% say that more than half of the managers have VDTs; and 25% say that more than half of their senior executives have terminals. This represents considerable penetration of terminals in the higher occupational levels of these organizations.
- Most PCs in these organizations are not yet able to download or upload data from central sites. 65% of respondents say that less than 25% of PCs in their organizations can now download data and 68% say that less than 25% can upload.
- A majority of respondents rated their organizations as either advanced overall in OA applications or advanced in some application areas. (20% classified themselves as "highly advanced overall"; 34% "advanced in some areas"; 21% "mainstream user"; and 23% "behind the mainstream, overall." 2% did not respond.)

- When asked which function in their organizations has "the most decisive voice in adopting overall office automation plans and policies," 56% cited the data processing or EFP function. User or operating departments were cited in 21% of the organizations; an office-systems or OA group in 8%; the auditor or controller in 4%; senior management in 3%; and "other" for 8%.

Having fleshed out the types of organizations and reporting sources we developed to assess privacy and security issues in OA, we turn first to the broad snapshot of conditions and concerns provided by our survey of computer security professionals in 301 large-scale business and government organizations.

4.4.2 A Snapshot of Privacy and Security Aspects of OA in 301 Organizations

The value of surveying computer security professionals is that they are the organizational staff persons charged with operating responsibility for security. Often, these professionals are also responsible for administering compliance with privacy, confidentiality, and due process rules, though this responsibility may be lodged in some organizations with user departments, a special "Data Privacy Committee," or, in government, with privacy/FOI officers. However, even in the latter situations, our site visit experience suggests that security officers are often conversant about privacy matters. Where we feel that respondents to our survey may not have had sufficient knowledge to answer a privacy question in an informed manner, we will note this, especially where such is suggested by non-response rates or the structure of the answers.

We will also be reporting here on the presence of significant differences of experience or opinion between business and government sectors. (Our sample of computer security professionals in non-profit organizations was too small to warrant comparisons there.) If no comment is made on business-government comparisons in reporting on responses, this indicates that no significant differences appeared in our data.

A. Overall perceptions of privacy and security in OA

Our survey excluded "dumb terminals" from its scope, and asked respondents to focus on "personal computers" and "word processing equipment." Seventy-three percent of respondents believe "it is significantly harder to apply security and privacy measures in the OA environment than in traditional EDP areas." (10% disagree, 10% gave a "neutral" response, and 8% did not answer.) Such agreement by three out of four computer professionals indicates a very widely held judgment about increased risks to privacy and security interests in OA settings by security professionals in large organizations.

We also asked about specific dimensions of OA operations and their presumed effects on privacy and security interests. There was broad agreement on security related risks:

- 64% believe that "the spread of electronic mail/message systems poses real problems in restricting confidential information to those with a need to know." (14% disagreed, 12% were neutral, and 10% did not respond.) This view was taken by 70% of respondents working in business organizations but by only 38% of those in government.
- 76% agreed that "the OA environment allows more people to have physical access to work stations and disks to which they were not authorized than was true in the earlier EDP environments." (14% disagreed, 4% were neutral, and 6% did not respond.)

Opinions were more divided on privacy-related exposures in OA, reflecting not only less certainty as to risks but also probably the lesser direct experience and expertise of these security professionals with privacy practices. However, the responses here still show significant belief in increased privacy risks.

- Almost half (47%) believe "as a result of inexpensive, decentralized OA," that "there is a trend for broader or more detailed personal information to be collected about clients or customers." (18% disagree, 21% are neutral, and 16% did not respond.) 38% agreed with a parallel statement that OA leads to greater data collection about employees. This belief in expanded data collection in OA is held more heavily by government respondents (56%) than respondents working for corporations (39%).

- A similar almost half of the respondents (45%) agree that "Proliferation of personal computers is leading to lower compliance by managers with government privacy regulations such as the Fair Credit Reporting Act, employee privacy laws, Federal Privacy Act, etc." (16% disagreed, 26% were neutral, and 14% did not respond.) While we did not ask for examples or pose follow-up questions to investigate what kind of non-compliance the respondents had in mind, it seems clear that almost one out of every two computer security professionals believe that this privacy exposure is present. Government employees believe this significantly more (49%) than corporate employees do (32%), probably because of the more comprehensive and monitored privacy rules for Federal agencies.

There was not a majority opinion among these respondents as to whether corporate or federal-civilian agencies were further ahead in dealing with OA security and privacy issues. Our question asked for agreement or disagreement with this statement: "In general, civilian federal agencies are probably ahead of the private corporate sector in applying security and privacy measures to OA." Asked in that form, 37% agreed, 24% disagreed, 26% were neutral, and 13% did not respond. (The agreement was identical between corporate and government respondents.) As we will note later, in reporting the results of our site visits and Federal agency inquiry, we believe that federal civilian agencies are ahead of the corporate sector in writing new OA security and privacy policy statements and in beginning end-user education on such issues.

However, our question asked about "applying...measures," and that may have evoked an image of action procedures among these respondents, beyond policy statements and communication.

B. Senior management awareness and action

We asked whether "Senior management in my organization is aware of security and privacy concerns in office automation." This question employed the mixed "security and privacy" term that is often used in computer security discussions, but it has the difficulty, as we have noted, that security and privacy considerations overlap but are not identical. Sixty-two percent of respondents said their senior managements were aware, 25% disagreed, and 17% were neutral. Government respondents were significantly higher (69%) in believing that their senior managements were aware than corporate staffs thought (44%). Again, we believe this reflects the more institutionalized and visible attention to security and privacy issues in the federal government than in most corporate organizations, except those with especially sensitive security and private issues (banks, hospitals, etc.).

We also asked whether "Senior management is giving adequate financial support to providing office automation security and privacy measures in my organization." Only 30% believed that such financial support was "adequate," while 45% said it was not. (25% were neutral on this question.) There was no substantial numerical difference between corporate and government respondents on this issue.

C. What organizations have done about assessment of OA security and privacy

As of late 1984, 80-85% of these organizations had not yet taken active steps to either assess OA security and privacy exposures, to formulate new policies, or to audit performance under such standards. Specifically:

- Only 21% of respondents report that they have done "a formal survey of OA security/privacy practices and conditions."
- Only 15% report they have done a risk analysis of OA security practices.
- Only 23% say they have done any auditing of OA privacy and security conditions.

However, almost a third of respondents (31%, 32%, and 33% in the sequence above) report that they have "current plans" to do each of the three things mentioned.

D. Extent of end-user education and communication

As far as the education of end-users of office systems technology, less than half of these organizations report activities to sensitize users of micros and PCs to standards, procedures, and responsibilities in handling sensitive information.

- Only 42% say that end users have received any kind of "policy statement on security and privacy."
- Only 37% say end users receive "education about security and privacy in user training."
- Only 36% say there has been "discussion of security and privacy in organization newsletters or other periodic communications."
- Only 36% say user responsibilities are discussed informally by a security officer.
- Only 42% say such responsibilities are discussed informally by a supervisor.

In three of these areas of end-user education, government organizations are reported to be doing more than private businesses. 56% of government agencies say OA users have received a policy statement on privacy and security, to 38% in business. 47% of government agencies report including security and privacy in user training, to 37% for business. And, 52% of government agencies report that security officers have held informal discussions with OA users on their privacy and security responsibilities.

E. Confidentiality and security breaches in these organizations

To get an idea of the extent to which "computer-based" confidential information has been known to have been disclosed improperly in these organizations, whether in EDP or OA settings, we asked a series of questions about such incidents. (17% did not respond)

- 12% report that someone inside their organization leaked computer-based personal data about clients/customers to an outsider.
- 14% report that someone inside their organization leaked computer-based personal data about employees to an outsider.
- 15% report that someone inside their organization leaked computer-based business or proprietary data to an outsider.

We then asked whether any outsider had obtained "computer-based confidential data" without "inside cooperation." 11% said this had occurred.

Finally, we asked whether OA users had engaged in "any violation of organizational security or privacy policy." 29% said they believed this had taken place in their organizations. Respondents from private-sector organizations reported significantly greater violations by OA users (32%) than did those from government (17%).

Following these questions, we asked those who had answered "yes" to any of the questions about leaks or outside penetration to describe the incident briefly. Fifty-five respondents (about 18%) supplied such examples. Figure 2 is a sample of those examples that deal with breaches of confidentiality policies regarding personal data.

Figure 2. Examples of Breaches of Computer-Based Confidential Personal Data

- "A person disclosed everyone in his department's salary."
- "Secretaries often give personal data to 'head hunters.'"
- "Release of data (on) active duty marines with names and duty stations (which was) sold to private firms."
- "An employee was caught selling mailing lists."
- "A leak in confidential electronic mail (by) a secretary who couldn't keep her mouth shut."
- "Lists of customers' address changes."
- "Someone entered [database] batch job. Obtained salary info, etc., given to head hunter."
- "Insider with access to subscriber lists, submitted them to an outsider, for the latter to use in mailing info contrary to the interests of my organization."
- "Management bonuses were leaked to the press via union executive."
- "List of employees to be terminated."
- "Compromised customer list."
- "Name-address of employees for mailing solicitations."
- "Head-hunter quoted total annual remuneration (including bonus amount) to officer employees."
- "Address list of potential union members."
- "Customer addresses; employee phone numbers and date of birth."

Several things are striking about this list. Our respondents did not give us a single example of the kind of cause celebre confidentiality violations from computer-based data that have been well reported and authenticated in the computer and general media over the past decade or two -- obtaining confidential data on credit-worthy persons and buying goods or obtaining money through such acquisition; obtaining confidential medical data on patients for insurance-fraud investigations or for media reporting on celebrities; breaching confidential data for political campaign or election purposes; obtaining confidential data on leaders of dissident groups or radical organizations; etc. The closest example to those kinds of episodes were the mentions of union-related breaches of confidentiality. In all the other examples, it is commercial advantage (stealing client lists for business solicitation purposes) or violations of employee-confidentiality rules (getting confidential salary data) that are mentioned.

Just what the absence of such privacy-based violations from the responses signifies is not entirely clear. Since this was an anonymous survey, and since it is in the general interest of computer security professionals to publicize real violations they are aware of (which helps justify staff and money to protect against such acts), we could assume that there was no self-interest for these professionals to hold back citing serious privacy breaches. Or, it could be assumed that these professionals did not want to admit that their efforts had not prevented such episodes. We think this is unlikely, since no reasonable person expects all breaches to be averted, and it would not reflect adversely on security professionals if examples of some violations were reported. Another interpretation of the results is that the "celebrated stories" are actually very rare, and their absence from reports by these respondents is a useful documentation of that fact. We find this hard to accept, since the 301 respondents came from just the kinds of private firms (banks, credit card firms, hospitals, etc.) that have been the settings for celebrated violations.

Therefore, we can only conclude that the asking of a series of questions (see wording, Appendix, page 88) and then asking for the "most significant incident" did not sufficiently guide respondents to cite the personal-privacy examples rather than the trade secrets, business-property type of violation.

We also asked respondents what disciplinary actions have been taken in these organizations when any kind of "security breach" is discovered (not necessarily in OA). 46% say that someone was warned; 12% say someone was suspended; and 33% say that someone was dismissed. The report that someone has been dismissed for a security violation in 100 out of 301 organizations participating in this survey suggests that serious attention is being given to such conduct.

F. Policies and safeguards being used to protect privacy and security

We supplied respondents with a listing of various protective measures that have been applied to "traditional EDP environments" and asked them if their organizations currently applied any of these "in office automation applications using personal computers or word processing equipment (not 'dumb terminals')." The replies indicated relatively low levels of available safeguards being applied in OA settings:

In the area of physical security and media control:

- Only 19% say that they label "sensitive" documents with classifications in the system or with warnings at the top or bottom of printout pages.
- Only 14% have protections against unauthorized duplication of programs or data.
- Only 45% say that diskettes are locked up.
- Only 50% say that their computer system is physically secured.
- 52% report they locked up file cabinets; 35% locked up paper documents; and 22% lock up forms.

As far as technical measures are concerned:

- Only 33% say logging (journaling) is done.
- Only 17% check data integrity (out of range data, etc.)
- Only 16% use "anti-hacker" call-back device.
- Only 8% use cryptography.

The most commonly applied technical measures are that 68% say that some functions require a password and 61% say that user identification is required in some functions.

In terms of privacy guidelines, 46% say they have these for salary data; 41% for medical data; 35% for financial data; and 24% for strategic planning data. Only 24% say they have an "ongoing risk analysis program" and 35% say they have a training program for security and privacy awareness.

G. Desired security or privacy policies for the OA environment

We asked respondents to nominate "one security or privacy policy for the OA environment that is not currently in place" in their organizations that they "would want to see done." 186 of the respondents provided narrative answers. While a few said that they needed so much that they couldn't specify just one needed measure ("Everything! almost nothing is done now"), 180 did choose a priority. The 12 policies cited most often were:

- Written organizational policies on OA privacy and security.
- Specify who owns data and is responsible for its protection.
- Identify and classify sensitive data needing protection.
- Set need-to-know confidentiality rules.
- Require training and awareness programs for end-users.
- Require physical security for terminals or the areas they are in.
- Lock up diskettes and storage cabinets.
- Install passwords and sign-on controls, and monitor their proper use.
- Employ audit trails.
- Strengthen enforcement of policies and sanctions for violation.
- Make annual assessment of OA security and privacy practices.

H. Opinions as to security enforcement and legislation

To get an idea of how far security professionals thought it was necessary to go to find out what end users are doing at their terminals, and thus how well privacy and security rules are being followed, we asked respondents whether they thought that "periodic, unannounced searches of end-user personal computer discs" was "essential to enforce security and privacy policies in the OA environment?" 34% felt this was "essential." 27% did not agree, 32% were neutral, and 7% did not respond.

We also asked whether they thought state laws on computer crime were adequate or whether a "uniform federal computer crime law" was needed. 80% were in favor of a uniform federal computer crime law. 9% disagreed, and only 2% were neutral and another 2% did not respond.

I. Summary of Survey Implications

We read the survey results as indicating that computer security professionals from large-scale business and government organizations believe that the advent of micros and PCs in office use poses significant privacy and security risks. To be sure, some of these risks are simply extensions into the OA environment of manual-era and EDP-era privacy issues (defining what is confidential and who needs to have access) or security issues (educating and training users, installing and policing proper password use, preventing insider leakage of proprietary information, etc.). However, the survey results suggest that many of these professionals see some privacy and security problems as special to the environment of micros and PCs:

- Broader or more detailed data collection on clients (47%) or on employees (38%);
- Lower compliance with government privacy rules (45%);
- Problems in controlling need-to-know access in electronic mail systems (64%);
- More people having access to terminals and diskettes to which not authorized (76%).

These are not privacy and security problems that are different in character from those faced in EDP systems. But these respondents are saying, as we read it, that the settings and dynamics of OA operations in their organizations are creating new exposures and vulnerabilities, and that existing policies and procedures, framed for manual and EDP environments, do not automatically or adequately cover the new OA-system risks.

As of the end of 1984, however, these respondents say their organizations have not yet formulated, applied, and communicated the kinds of explicit policies and procedures as to privacy and security that would address the kinds of uses and operating conditions involved in micro/PC proliferation in their organizations. This suggests that key staffs within organizations are still in the "problem identification" and "early risk assessment" stages of response.

The fact that a third of these organizations say they have current plans to do surveys of OA privacy and security practices and conditions suggests that this situation is changing. Also, what we regard as the high quality of the list of new policies for OA data protection that these professionals want their organizations to install suggests that there is a good understanding of what needs to be done to bring OA data protection up to a responsible level of compliance. Finally, the judgment that senior managements are "aware" of growing security and privacy issues in OA suggests that, as these issues are further publicized and exposures are identified, organizational support for responsive policies will probably be able to proceed on the "base" of such present awareness.

Most important, perhaps, is that the results of this substantial survey of active business and government OA users provides support for the detailed findings of our site visits and Federal-agency contacts, to which we now turn.

4.4.3 Site Visits and Follow-Up Contacts to Organizations Leading in OA Applications

The 70 organizations whose privacy and security policies we looked into during our VDT project (see Section 1 for details) were organizations with sensitive client information: corporations such as banks, brokerage houses, law firms, hotels, insurance firms, credit-card companies, hospitals, universities, etc.; government agencies (covering taxation, housing, education, courts, law enforcement, civil service, etc.); and non-profit organizations (labor unions, foundations, religious bodies, etc.). We will also be discussing in this section employee data privacy issues in the application of OA to personnel administration other than the VDT work monitoring issues already treated in our first OTA report.

A. Existing privacy and security policies in EDP systems

The organizations we visited fell into three basic groups as far as existing privacy policies were concerned in 1982-83:

(1) About a third of these were leaders in the promulgation of client privacy and employee privacy codes, and already had in place, from the 1977-1980 period, fairly detailed rules and procedures covering the data collection, confidentiality, and subject-notice-and-access dimensions of privacy protection. These organizations were like the well-known examples of IBM, Equitable Life, Bank of America, and American Express; federal and state agencies governed by and responding to fair information practices laws or area-specific statutes and regulations on privacy; and non-profits complying with some privacy laws governing their record-keeping and also operating in an "anticipative" pattern, exemplified by Harvard University, the Multi-State Psychiatric Information System, and the United Automobile Workers.

(2) About a third were in the process in 1980-83 of issuing privacy codes and procedures, generally identical to those issued in their industry or government sector by the early-starters in our first group. (One example of such a privacy code issued by a brokerage firm in late 1983 is presented later in this section.)

(3) About a third had no formal, written privacy policies for client or customer data in place. Officials in these organizations explained that they met legal duties and handled client data properly but had not "felt the need" to issue written privacy policies.

As far as security policies and procedures, all of the organizations we visited had some physical security, access (password) controls, and basic audit procedures in place for their EDP mainframes, minis, and on-line (dumb) terminals.

Finally, as noted earlier, the organizations we visited were advanced users of OA. With varying degrees of penetration, most had extensive clerical applications in word processing, data entry, and customer service; professional work stations and electronic mail/message systems; and managerial/executive micros and PCs for both personal computing work and mail/message uses.

B. Status of OA privacy and security actions as of 1982-early 1984

During the April 1982 to early 1984 period when most of our initial site visits were done, the following was the state of organizational policies as to OA privacy and security matters in over 90% of these organizations:*

- No assessment or risk-analysis of privacy and security exposures in OA systems had been done.
- No attempt had been made to analyze the content of personal client data (or other data) being used in OA applications involving multi-terminal exchanges, to classify information as to sensitivity and develop confidentiality classifications.

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* We excluded dumb terminals from our examination here, focusing on micros, PCs, or word processors with intelligent capabilities.

- No re-issue of existing privacy policies or newly-written privacy rules had been provided to the new end-users receiving terminals for OA applications.
- No written materials on security responsibilities or procedures had been issued to OA end-users.
- No training or educational package had been provided for OA end-users on privacy or security issues.
- No audits or inspections had been conducted, or even any interviews, to determine what client personal data end-users might be putting into their micros and PCs, in the form of "desk notes" or personal databases.

Though this was the situation in over 90% of the organizations we visited down to early 1984, two observations need to be made, both of which will be developed later in this section. First, in about half of our 70 organizations, concern about potential privacy and security breaches -- involving the handling of client and employee data in micros and PCs -- was voiced by EDP staffs, OA specialists, or human resources staffs that covered privacy issues in general. Secondly, we found a move from this staff concern to initiation of new policies and measures was clearly under way in late 1984. In the follow ups we made to 15 of the original 70 organizations, in September-December of 1984, about half the organizational officials we spoke to reported they were beginning OA privacy and security reviews, new policy formulation, or creation of end-user communication or training programs.

C. Potential and experienced privacy and security breaches in OA applications

We present here a set of concerns that were expressed to us by staff members during our site visits and examples of breaches of confidentiality that had already taken place. We also include some examples of breaches that were related to us by other organizational staff members we interviewed in the course of our VDT project. In a sense, these make up a forecast of threats as well as an inventory of early violations that can serve as an agenda list of potential threats to privacy and security interests involving client and employee personal data.

- At a telephone company, six repair service attendants who used CRTs to look at customer repair records attempted to enter a new human resources information system to look at confidential employee and executive records. This was detected when a computer log showed a repeated series of "security violation" messages generated by the repair-service employees' attempts to enter the HRIS system without the proper passwords that this system required. The employees were disciplined. A telephone company expert told us that the detection and safeguarding of the confidential data here took place because this was basically a "traditional" EDP system with good password and logging measures. "When authorized PC users download data from such central files, we don't have either password or logs on their machines, which are part of a multi-terminal minisystem. A repair service attendant who used an unattended PC could get into all the sensitive HRIS data being used by region, division, or local unit personnel staffs."

- At several newspapers, the VDT system put in for reporters was set up so that each reporter had a "private" file in which he or she could keep confidential-source information, sensitive interview notes, and other material that no-one else was supposed to see. However, reporters told us that the security was so slight that many of them have learned how to break in and browse in other reporter's files. There was growing concern over this condition, and a complaint to management to either set up a more secure system or else inform users that the system wasn't really secure and warn them to go back to using paper for whatever they didn't want others to read.

- At about a dozen of the organizations we visited, we were told stories of "misuse" of the electronic mail/message system. People would browse through other people's messages, dirty jokes would appear "anonymously contributed," complaints about management policies would be sent onto the system (also anonymously), and confidential information would be deliberately "leaked" onto the system. These organizations were beginning to develop identification procedures for all messages accepted by the system, policy statements about types of messages not to be sent, logging of distribution instructions, and similar measures. As one staff member told us: "Electronic message systems are the new version of the office water cooler -- a place for gossip, making dates, blowing off steam, etc.

When it was done orally, with no record, it seemed harmless or even useful for the organization. Now that it's electronic, can reach hundreds or thousands of people, it takes on greater impact. We have to do something, but we don't want to overreact either."

- At the mayor's office in a large city, which had brought micros in for professionals and managers, they were downloading sensitive data on individuals from real estate files, tax files, and licensing files. The OA director commented: "We are going to have to see that users can download the data from the state capitol but not change it, and that we have adequate security on these files while they reside in our systems." This city is also moving to have various types of institutions able to enter transactions directly into city account files from the institution's terminals (such as tax payments, in EFT flows). This is also seen as requiring security controls to avoid such institutions accessing other data in such systems or making any changes in files.

- A hospital we visited is one that has celebrity patients, whose condition is of interest to the media and for which reporters have long paid for "tips" from hospital employees. Medical records on the hospital's own employees are also a sensitive database to protect. This hospital has moved these databases onto mini systems, and has made them accessible to micros scattered throughout the hospital. When these were manual records, they were in central record rooms or at nursing stations, where unauthorized employees would be noticed if they went into a record room or asked for a lab report or patient file that they had no need or authority to get. The hospital administration was concerned that the presence of terminals in offices that were often left unattended (and the terminals had no key locks) or in group work spaces could result in violations of confidential records. They know they can install passwords and logs, but they are concerned whether the expense and slowdown caused by such measures might be serious.

- At a large law firm, the office manager was worried about the confidentiality of sensitive client files. She created a null file labeled "CONFIDENTIAL," to test security on the system, and found that it had been accessed eight times in one day. The system was set to go on line to offices of this firm in other cities, and this set off worries about hackers breaking in and learning of highly sensitive information about identity of clients, their proprietary products, litigation positions, evidence, etc. For its on-premises operations, the firm has instituted security steps so that no operator is able to delete a file, sensitive material is taken off the system and the data file is locked up in the manager's cabinet overnight or off-shift, and similar measures.

- At a high-technology firm, a manager made "adjustments" in the electronic mail system so that all the mail and messages designated for other executives, and to which he was not an addressee, appeared on his desk terminal. The company, when it learned of this, saw this as a kind of computer theft, but it realized that it had not set rules of confidentiality for message routing on its electronic mail system and decided it should start considering what was needed by way of rules and controls to protect confidential information in its internal OA systems.

- In a chemical company, some "hacker" engineers broke into confidential files they were not authorized to access. They were detected on the basis of some routine auditing of which terminals were auditing which databases. The company took disciplinary action and publicized the breach throughout the firm. It's position is that the way to deter "internal hackers" from getting into sensitive files is to catch some and make an example of their punishment.

- At a large bank, a senior personnel executive was concerned over the plan of the DP function to put micros on the desks of supervisors throughout the organization, and to let them have on-line access to personnel database files. "This operation is designed to give 100% service for what is clearly a 1% problem, something that could have been handled on a much better basis if the personnel specialist only could have access to this data, or if the supervisor made a request for these employee records to the personnel function." Under the DP plan, the supervisor would have access to employee loan information, employee depositor account information at the bank, benefits information, pension beneficiary data, and other sensitive information that the senior executive felt "it was clearly inappropriate for supervisors to get." As a result of this executive's concern, a task force was set up to re-examine this micro application, and to recommend stronger confidentiality safeguards.

- At one terminal vendor we visited, a technical specialist commented to us that the combined voice-data terminal this firm marketed (combining a telephone system with a data terminal connected to a central processor) was a "bombshell of an eavesdropping device waiting to go off." He explained that these kinds of terminals have a built in microphone that can be activated by a software command from the managers of the organization (at the host) -- or by hackers who might break into the system -- and this would turn on the microphone silently in the room where the terminal sat. Without any noise or light indicating that the telephone conversation or room conversation was being overheard, the management or a hacker with a compatible system could listen to those conversations at length, for days, weeks, or months, without any way of being detected at the "turned on" terminal. The engineer was wondering whether manufacturers of these devices ought not to be building into them some kind of notice-device or audible cue. "If it gets out that we have put this super Big Brother machine into thousands of offices, we may find ourselves in a lot of trouble, and people's privacy may really be in peril."

- At one bank, an officer in the loan department expressed concern that loan account executives might start doing analyses of personal and family financial conditions on their PCs, and applying their own "credit-scoring" systems. He was worried that this might violate provisions of both the Fair Credit Reporting Act and Equal Credit Opportunity Act, which require informing credit applicants of decision-making criteria used in denying them loans.

- A senior personnal executive responsible for EEO asked all supervisors and managers to refrain from using any racial or other minority designations in putting attendance or disciplinary records onto their PCs. This arose after one supervisor mentioned that she was keeping such records "much more efficiently" than with sheets of paper in her desk.

- A similar concern was expressed by the head of an underwriting department in a large insurance company, who was thinking of issuing a notice to underwriters not to create their own files of personal characteristics of policy applicants, even for purposes of "testing out" various relationships between lifestyle or personal behavior and approval or rating of policies.

- In a law enforcement agency which includes a unit responsible for investigating potential terrorist or radical groups, a policy is under discussion as to whether "intelligence files" on groups and individuals should be kept only in a locked micro within the unit's central office space; be kept by each member on his own PC or micro; or allowed to be "taken home" and kept off premises. Recent lawsuits have required police departments to produce their (up to then) manual records on groups under surveillance, and some suits have resulted in court rulings finding the police record keeping to violate First Amendment rights, resulting in damage awards and injunctions against improper record keeping. How to "follow the law" but also make use of OA capabilities for data processing is the issue being discussed.

This selection of incidents, concerns, and policies under consideration illustrates the kinds of issues that we found at many of the sites we visited, and at those that were recontacted late in 1984.

D. Active policies on privacy and security among these organizations

We noted that a few organizations we studied had, by the end of 1984, begun to promulgate new policies and take other steps to identify and respond to new exposures in OA applications. We will describe here examples from the business sector, and save our examples from federal agencies for the full discussion of federal practices in the next section.

First, we reproduce in the following pages the Client Privacy Policies of a brokerage house that were issued in November of 1983. These were distributed to all employees, with a letter from the chief executive officer indicating that the presence of sensitive information in the firm's "client base" made it imperative to see that "this information is handled ethically and with the greatest regard and respect for every individual's right to privacy." Operation of all systems under this code, the letter added, "will enable us to maintain the client trust and loyalty we currently enjoy as well as to meet any challenges that might be posed by legislators, competitors of consumer advocates concerning the privacy issue."

PRIVACY/FAIR INFORMATION PRACTICES

CODE OF CONDUCT

The nature of the services offered by (the "Company") necessitates collection and retention of a substantial amount of personal information about the individuals to whom services are provided. We must avoid any unjustifiable intrusion into an individual's privacy. We must strive for a reasonable balance between the operational needs of our businesses and the personal needs of individuals. In an effort to attain such a balance we will be guided by the following principles with regard to the collection, custody, and distribution of personal information concerning the individuals to whom we provide services.

(1) Obtain only that personal information which we believe is necessary to the conduct of our business.

(2) Use only lawful means to collect information. To the extent practicable, obtain information directly from the individual; make reasonable efforts to assure the reliability of information acquired from others.

(3) Establish administrative, technical and physical safeguards so that access to our central personal data records for both employees and customers is limited to authorized persons. Provide secure storage for these records.

(4) Personal information in our central personal data records for both employees and customers is to be disseminated only by and to those with a legitimate business purpose or regulatory function, or where disclosure is required by subpoena or other legal process.

(5) Advise the customer of the Company's policy with respect to mailing lists and provide the customer with the opportunity to have his or her name removed from such lists.

(6) In cases where the records of an individual customer are subpoenaed, promptly notify the individual unless specifically prohibited from doing so by court order. Respond according to law, but wait the maximum practicable time in order to give the individual whose records are subpoenaed the opportunity to exercise his or her rights. Exceptions to the aforementioned notice policy are cases of suspected fraud or possible criminal activity against the Company or against the industry when it is reasonably possible that the Company may be among those injured.

(7) Upon request or as required by law, notify all customers, where practicable, of the general uses and types of personal information that may be collected regarding them and inform them of our practices in disclosing this information to third parties.

(8) Upon written request, provide customers with the reasons for adverse determinations which have been made about them, and advise them of the nature of the information acted upon, except for information which relates to the investigation of suspected fraud or of a possible criminal offense. Be careful to comply with the Fair Credit Reporting Act and other applicable laws and regulations. Disclosure of these reasons must be safeguarded to protect personal privacy and must not be communicated to any party other than the customer or customer's agent or broker except as authorized by the customer or as required by law.

(9) Upon written request, and within a reasonable period of time, advise an individual of information maintained about that person in the Company's central personal data records except with regard to information which relates to the investigation of suspected fraud or of a possible criminal offense. Inform the individual of the opportunity to verify this information and to provide corrected or amended information where applicable.

(10) Review, as appropriate, corporate policy regarding the collection, retention, use, and protection of individually identifiable data to ensure that this policy is in keeping with the shifting needs of both the business and the individual.

Ensure that all affected personnel are continuously made aware of their responsibility to the Code. It is the employee's responsibility to preserve the confidentiality of records and maintain fair information practices.

This Code of Conduct applies directly to the Company's relations with its individual customers in connection with the services provided by the Company. The principles expressed in the Code will also govern the Company's dealings in its relationships with its employees.

The security director (in the EDP department) is currently engaged in translating this client privacy code into new privacy and security policies for micros. The organizational goal is to keep "client sensitive data," as identified by a ranking structure, from being downloaded from central databases to micros and word processors in headquarters or regional units unless there are proper security safeguards. The same is true for downloading and uploading from micros that their brokers have in the field; these are used to maintain "local broker" files on their immediate clients but also to compare central file data on these clients with information in the local file. Although there are no federal or state privacy laws for broker records that have to be followed (comparable to laws on banking, credit, or insurance), the security director believes that brokers in the field "don't know much about our privacy code and don't appreciate how confidentiality can be compromised by people taking their diskettes and reading them on other machines or altering them."

The firm's approach to these conditions is twofold: (1) it plans to initiate an educational program for brokers using micros, and is considering purchase of a "Private and Security" self-instruction program available on diskette from a commercial vendor; and (2) it has beta tested and plans to purchase an encryption package that will provide terminal-entry and log-on controls, file encryption, and access controls to the mainframe for downloading purposes. The security director sees these activities as taking place in the next six months.

A second example of corporate activity involves a large high-technology manufacturing organization with a strong reputation for progressive employee relations policies. This organization has had very explicit privacy policies for employee and client data for almost a decade, and also has a corporate-wide Privacy Review Committee. This Committee examines proposed data systems and computer applications to assure compliance with U.S. privacy laws, the OECD guidelines for overseas operations of this firm, and the company's own extensive privacy guidelines and procedures. During our contacts with this firm in 1983 and 1984, we learned of office applications and micro uses being examined by the Privacy Review Committee, and significant privacy and security measures being incorporated in response to such review. Among the actions taken on OA privacy and security were:

- The privacy policy on automated personnel data systems was expanded to include micros and PCs being used in the Personnel function.
- The principle was established that protection of privacy in micros and PCs is the end-users personal responsibility, and such users will be held accountable for its assurance.
- Security for sensitive personnel data downloaded to micros includes: the PC must be in an isolated room within the personnel function in each unit, and not be shared with any non-personnel user; diskettes must be stored under lock and key when not in use; the Personnel Director or Manager at each site accessing central data from a micro must "commit in writing that he/she understands the requirements for privacy and will administer these according to written company policies."

Privacy and security are a regular topic at the meetings of the personnel group each year, and sensitizing micro and PC users has been part of these discussions. The manager of the Privacy Review Committee has stressed that the lower level of sophistication on legal and regulatory requirements as to privacy on the part of the growing corps of personnel end users is a danger that has to be addressed, and that is the focus of this firm's current educational campaign.

In addition, in the reviews of proposed systems that the Committee undertakes, special micro issues have been addressed. For example, an "Incident Management System" was being developed by one department. The review focused in its privacy aspects on the possibility that "inappropriate employee evaluative data" might be put into the micro or be kept on discs off premises." There was also concern about the risk of inconsistent data on an employee if changes were made in a central database or on a free-standing micro without changes in the other location. There was also a requirement set that employees would be able to know what was recorded on the micros, and to be able to examine, correct, or challenge the incident records. The system developers were also advised that special attention should be given to a proposed narrative field called "comments." "This could be problematic if subjective comments of a derogatory nature are entered. Management users of the system should be aware that computerized records are being utilized in court cases. The Performance Appraisal System is preferred as the vehicle in documenting performance factors of employees."

In the security aspects of the review, the Board set requirements for securing the employee number from accidental or intentional intrusion, since this was the "primary control" for payroll and personnel systems. Other information identified as requiring special safeguards were home telephone numbers (some are unlisted); skill level codes (where there should not be variance between micro and central file designation); and data on sick leave and vacations (not to be seen by those without need to know). Physical and facility security standards were cited, and the system developers were given reminders that terminal equipment must be in a locked room; the operator manual must be secured against use by unauthorized persons; passwords must be limited to the personnel director and authorized technicians or administrators; and the passwords must be changed every 60 days or sooner if someone transfers out of or terminates from the office.

Finally, the review of this system dealt with employee due process:

> "Basically, the whole issue of data privacy can generally be covered by being 'up-front' with the employee regarding record keeping systems. Advise them of what is being collected, for what purpose (how it will be used), that it will be protected in accordance with corporate policies, and that employees have a right to view their records (plus obtain a copy if desired). Consideration should be given to printing a data privacy statement on any data collection forms. Such statements advise the affected employees on the use and protection of the information."

We have included in the Appendix copies of the Privacy Review Committee charter of this company, and also its detailed policies and procedures for operation of automated personnel data systems, which covers micro applications.

A third and final example of active policy development involves another high-technology multinational firm. This organization has several pertinent characteristics to be noted. Its employees and professionals have extensive experience with and orientation to computers, so that its management feels it has "fewer naive end users" than most other corporations going into extensive OA. It has network connections to most of its micros and PCs. It has a corporate culture attuned to privacy and security policies as a continuing, major concern, not just a "solved problem" or a ritualistic compliance with legal commands. At the same time, management wants its employees to use data more and do much more personal computing; it sees this as a future edge in organizational performance. "Give a manager in this company a micro or PC and he'll create a database so fast it would make your head swim," one security executive commented.

This organization has had a series of internal staff and task force reviews of privacy and security issues in OA systems and stand-alone micro/PCs. It draws a basic distinction between these two kinds of activities:

- When PC users enter mainframe or mini systems, controls must come from the central system. Central system managers are responsible, must set availability and access classifications for all users, enforce restrictions, and audit compliance. PC users need to be told the policies and trained to follow them.
- When PCs are used as stand-alone devices, the end user can and will do things that the central system -- or a neighboring employee or a manager -- does not know about. Therefore, for such activities, the end-user must be made the responsible party, just as much as if he or she were writing things down on yellow pads or typing memos. The end-user is the "information manager," and must be informed by the management of the legal rules, regulations, policies, and procedures to be applied from a privacy standpoint, as well as required security measures to be followed. However, management will not control the PC user as it does the online terminal using the central system. Education is the key.

This organization has produced a film on protecting information in an expanded computing environment, along with a discussion guide for use by managers. It is also developing a self-instruction program on the end-user's responsibility for information management that will be available on diskette, and will be provided for viewing by every PC and micro user.

4.4.4 Federal Agencies and OA Privacy and Security

A. The federal government and automated personal data

The Federal executive branch is the largest collector and user of client data in the country. Social Security, the Internal Revenue Service, the Veterans Administration, the Department of Health and Human Services, the FBI, Immigration and Naturalization Service and similar agencies with massive files on individual citizens are virtually wall-to-wall collectors of sensitive personal information about most of the American population. And, in its civilian and military personnel files, the federal government has the nation's largest collection of employee personal data. In addition, the use of what the federal system calls "ADP" -- automatic data processing -- has grown to enormous proportions over the past two decades.

Added to the broad sweep of federal record-keeping and its extensive ADP operations has been the public controversy over various federal record-keeping activities during the past two decades. Among those that generated controversy have been the U.S. Army's "civil disorder" surveillance, the use of Social Security files for regulatory programs such as the Parent Locater System, the FBI's plans for expanding the National Crime Information Center, and recent "computer matching" activities for determing fraud and abuse in federal social programs. Indeed, a major part of the debate over "Big Brother databanks" since the 1960s has centered on disputed federal-agency activites. It is in this setting that proliferation of micros and PCs in federal office work has to be examined.

B. The federal government as an OA user

Another point to discuss at the outset is the position of the federal executive branch as an OA user, compared to the corporate and nonprofit sectors. An often asserted judgment is that the corporate sector is, on the whole, "ahead of" the federal executive branch in installing OA. While this may be true if one uses measures such as percentage of word processors per secretary across the federal system compared to Fortune 500 business firms, we do not believe it is correct in terms of pursuing advanced applications. From our site visits to 110 private and public sector organizations, the responses to our inquiry into OA activities at federal agencies, and other sources, we think the situation is more complex than this assertion captures:

(1) Some federal agencies are significantly behind their counterparts in the private sector in both percentage of occupational groups with OA equipment and in advanced applications. Such was the judgment, for example, expressed to us by the Federal Reserve Board, in comparing its OA work with leading banks and financial institutions.

(2) Some federal agencies, or units within them, are clearly at the frontier in automating units such as customer-service or in specific OA applications. Examples are the IRS, several military agencies, the Executive Office of the President, and 8-10 other federal organizations.

(3) Many other federal agencies are in a "mainstream" of OA use by both penetration of machines and types of uses that compares closely to the mainstream of most industries, in which it is only a minority of firms that are doing the advanced OA work featured in the media or computer periodicals.

In short, we think it is a mistake to place the federal executive branch as a whole "behind" any other sector of the organizational community in the United States. There are advanced applications being pursued in many federal agencies, plus a drive for integration of information activities through Information Resource Management approaches, that is quite comparable to leading-edge activities in the corporate sector, and is probably ahead of most areas of the non-profit world.

C. The legal and organizational environment of federal OA activities

As noted in section 2, in our "baseline" discussion, federal agencies have moved into OA activities with detailed laws and administrative machinery as to privacy and detailed security guidelines for EDP systems and programs. In addition, federal-agency compliance with Privacy Act standards is monitored by the Office of Management and Budget; Congressional committees, interest-groups and the media (assisted by FOIA access), and by the courts (in Privacy Act litigation).

A somewhat parallel situation exists with regard to security. A duty is imposed on each federal agency by the Privacy Act to "establish appropriate administrative, technical and physical safeguards to insure the security and confidentiality of records and to protect against any anticipated threats or hazards to their security or integrity which could result in substantial harm, embarrassment, inconvenience, or unfairness to any individual on whom information is maintained." This duty, and the generally recognized need for information security in government data systems, has been implemented by security requirements and guidelines for federal agencies from the General Services Administration, the National Bureau of Standards, and OMB.*

As also noted in section 2, there is disagreement today between those who feel that privacy and security for personal information has been well handled by federal agencies and the OMB guidance process in the past decade and those who assert that agency compliance has grown steadily weaker and more mechanical since the late 1970s and that OMB guidance is virtually non-existent.[2] Which position one adopts depends primarily on whether one views privacy protection (1) as a public policy reflecting the ups and down of dominant public attitudes in a democracy (a pendular swing from high privacy concern and desire for controls in the middle 1970s followed by majority concern since 1978 over competing values of public order, program efficiency, and fraud control), or (2) whether privacy is considered as a constitutional-level right that should receive strong enforcement by government agencies regardless of shifting public attitudes, and with the kind of independent-Data-Protection-Agency-oversight that has not been installed in the United States.

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* See the list of such federal guidelines at the end of the Selected Bibliography.

D. Sources of federal-agency action

There has been no federal legislation aimed directly at handling personal data through OA-oriented systems or in micros and PCs, and no presidential executive orders on this topic. Rather, three forces have been the primary ones at work in the 1981-85 period:

(1) The role of the Office of Management and Budget, in its guidance role under the Privacy Act of 1974 and the Paperwork Reduction Act of 1980; OMB's security guidance under Circular A-71 (1979); and OMB's review of long-range strategies in each federal agency for ADP plans and projects, including budget approvals.

(2) The development of guidelines and coordinating position papers by the General Services Agency and National Bureau of Standards in 1983-84 for privacy and security considerations in end user computing and small office systems.

(3) Individual-agency initiatives, reflecting the existing state of ADP activities, the presence of large-scale files of sensitive personal information on clients, experience with and plans for OA systems and end user supply, the priorities of agency management, and the sophistication of ADP staff groups.

Before describing what has been happening in the federal sector, let us repeat the sources and limitations of our judgment. For the federal sector, we are drawing on the responses we received (with supporting documentation) from 44 federal agencies; information we obtained from other sources; and the interviews we did at seven federal agencies visited during our VDT field work. For comparison, we rely on site visits to corporate and non-profit organizations between April 1982 and April of 1984, and follow up contacts with business and non-profit organizations.

In all these examinations, we were looking at the perceptions of managers and staffs; the formulation of new policies and procedures; and the beginning of dissemination of these throughout the organization. We did not do on-site studies of the efficacy of these measures for privacy and security objectives or how early implementation might be affecting organizational performance or end-user behavior. Those will be important studies to conduct in 1985-87, but they were outside the scope of this OTA report.

We turn now to a brief account of the influence of OMB reviews and GSA-NBS guidelines on federal-agency development of privacy and security policies for OA applications.

OMB's role has been primarily to require all federal agencies to write detailed long-range strategy planning and justification documents to obtain approval of budget approvals for ADP expenditures. Because of OMB's role in Privacy Act, Paperwork Reduction Act, and security compliance, this has meant the inclusion of privacy and security discussion in these plans, discussion of these with OMB officials, and legitimation of privacy and security "requirements" in system design, vendor procurement specifications, and identification of management and user-department responsibilities in implementing OA. OMB has not been particularly concerned with the data collection and subject-access dimensions of privacy law but it has been concerned about breaches of confidentiality in agency handling of client data (improper uses or leakage to the public), and therefore with the security measures in OA applications to safeguard against such confidentiality lapses.

GSA has statutory authority under the Brooks Act (PL 89-306) to participate in setting federal ADP standards, including protection of systems and networks against unauthorized access, manipulation, and abuse. Under this authority, GSA has played an important role in alerting federal agencies to requirements for assuring privacy, security, and data integrity in designing, procuring, and managing end user computers. Two influential publications by GSA have been Managing End User Computing in the Federal Government (June, 1983) and End User's Guide to Buying Small Computers (August, 1984), which we found to be widely circulated among federal agencies. In additon, two important new FIRMR publications (Federal Information Resources Management Regulations) were circulating in Draft form in 1984:

> FIRMR 201-7, Security of Information Resource Systems is a compilation and update of earlier federal regulations on security of information resources, to be published in the Federal Register and distributed to federal agencies by the end of 1984. This includes requirements for privacy as well as security.

FIRMR Bulletin, Microcomputer Security, highlighting the importance of providing necessary security in micros. This Draft is to be published by April, 1985.

A copy of the 11/1/84 Draft of the FIRMR Bulletin on Microcomputer Security is included in the Appendix to this OTA report. We think it is an excellent orienting bulletin to agency heads and their staffs, and should serve to move the general level of federal-agency security policies significantly ahead.

The National Bureau of Standards, which shares authority under the Brooks Act to develop computer standards and guidelines, has issued important security guidelines for ADP systems and has published important privacy studies for EDP use for many years. In 1984, the Institute for Computer Sciences and Technology of NBS began circulating several important publications alerting federal agencies to security issues in microcomputer and small-computer-system applications: "Security of Personal Computers: A Growing Concern," April, 1984; "Security of Personal Computer Systems: A Management Guide," PrePublication Copy, September, 1984; and "Security Considerations for Small Computer Systems: A Preliminary Guide for Managers and Users," Draft Version, November, 1984. All of these publications were written by Dennis Steinauer of NBS, and represent excellent, carefully balanced, and expert discussions of security considerations, risk analysis approaches, available measures, and management/end-user responsibilities. The final version of the management guide was issued in early 1985. We include the Table of Contents in our Appendix.

E. Are micros DP or OA? -- some different agency perspectives

As these supervisory reviews, guidelines, and advisories were emerging in 1983-84, individual federal agencies were pursuing their own OA applications and their existing legal and managerial responsibilities to follow privacy and security requirements in all such systems. We found an interesting difference in emphasis among agency managements as to one aspect of fulfilling those responsibilities: whether OA applications, including the use of stand-alone micros and PCs, should be treated as an extension of DP privacy and security or as sufficiently "different" to warrant separate and special treatment. The first view was well communicated to us by the Department of Transportation:[3]

> We are introducing workstations which replace manual, electric, and electronic typewriters, for clerical support staff. The time to correct errors and make changes has been reduced significantly. The capability of clerical support staff has been increased with built-in electronic aids. However, much of the traditional data processing tasks are still being accomplished through data processing (DP) workstations, not OA workstations.
>
> Professional staff have acquired computer-based workstations to perform a wide range of functions. Our view of this work is that it is an extension of DP functions rather than OA. Managers are using computer-based workstations as tools to extend their analytical capabilities and as extensions of DP tools used in the past. There are very few managers and administrative assistant or executive secretary workstations clusters used for office and personal work management. The privacy and security issues, access to and availability of electronically maintained records, remain DP-related rather than OA-related issues. Traditional physical security precautions are used to safeguard personnel records.

A similar position was articulated by the Department of the Interior:[4]

> Office automation (OA) is established as a program in the Office of Information Resources Management. OA is described in the Departmental Manual, 385 DM 1 (copy enclosed), as the application of automated information technology to office activities. OA is viewed and managed, not as a separate technology or service, but as the linking or integration of any number of information

> technologies and services in order to maximize the productivity of the office. Planning for OA is included as a part of the IRM Long Range Plan (copy enclosed) which is updated annually. The copy furnished represents the most recent Departmental planning issuance on the subject as of September 1983 when the update was published.
>
> Policy and procedures for data security, data confidentiality, and data privacy are being developed in draft form at present and will deal with these areas from an overall information resources management point-of-view rather than specifically for OA application.

It may be that these positions reflect the high sense of unified-information-management at these agencies, and that their policies for dealing with stand-alone capabilities in micros and PCs will not actually differ significantly from those taking the second, "micros are different" approach we found at most federal agencies, and in the guidance documents of GSA and NBS. We simply report this difference in orientation as a factor worth noting for the future.

F. Major patterns of agency action, 1982-1984

Every federal agency maintains personal data on its employees, and thus has manual, EDP, or, possibly, OA-based personnel records that are subject to the Privacy Act and contain sensitive information that could be compromised by weak security. Since our focus in this report is on client data, however, we began our examination of federal agency patterns of action on privacy and security aspects of micro/PC use with the realization that the presence and sensitivity of these client data varied considerably across agencies. We will use this diversity to structure our analysis of agency actions.

1. Small agencies without significant client data

Some agencies (particularly smaller commissions and boards) have little or no identified personal data on clients.

The Foreign Claims Settlement Commission, with three word processors, wrote us: "The bulk of the information processed consists of information on claims filed by United States nationals for losses in other countries. Claiments are required to waive any privacy rights at the time of filing."[5]

The American Battle Monuments Commission noted that "None of the information that we maintain with our office automation requires special security measures other than keeping it and equipment under lock and key during office hours."[6]

The Advisory Council on Historic Preservation notes that its word processing system has "data limited to material of public record which is readily available under the Freedom of Information Act."[7]

2. Small agencies with client data

Some smaller federal commissions or boards report that they apply Privacy Act requirements to the client and personnel data that they do process through OA technologies, or say they have plans to do so under way. Examples we found are the Panama Canal Commission,[8] National Endowment for the Arts,[9] Federal Deposit Insurance Corporation,[10] Commodity Futures Trading Corporation,[11] and National Capital Planning Commission.[12]

The actions of the National Capital Planning Commission exemplify this trend among smaller agencies:

> The National Capital Planning Commission is a small, independent Federal agency and as such we are responsible for implementing and complying with the Privacy Act of 1974 which sets forth requirements:
>
> a) to assure that personal information about individuals is limited to that which is legally authorized and necessary, and
>
> b) to maintain such information in a manner which precludes unwarranted intrusions upon individual privacy.
>
> The requirements under the Privacy Act apply to all forms of records including automated records and data bases.
>
> This agency is just beginning an acquisition of microcomputers and we are in the process of developing procedures for data security/privacy.

The following are the draft procedures for "safeguarding automated administrative records" that the Commission plans to issue:

> Automated privacy and/or personnel records (including input and output computer documents, reports, floppy disks, magnetic storage media, and on line computer storage) are also subject to administrative, physical, and security safeguards.
>
> Management Services Section staff must take care to:
>
> 1) prevent careless, accidental, or unintentional disclosure, modification, or destruction of indentifiable data;
>
> 2) minimize the risk that skilled technicians or knowledgeable persons could improperly obtain access to, modify, or destroy identifiable personnel data;
>
> 3) prevent casual entry by unskilled persons who have no official reason for access to such data;
>
> 4) minimize the risk of an unauthorized disclosure where use is made of identifiable personal data in testing of computer programs or data bases;
>
> 5) control the flow of data into, through, and from agency computer operations;
>
> 6) adequately protect identifiable data from environmental hazards and unnecessary exposure;
>
> 7) establish and periodically change security passwords to access, store, and retrieve personnel data;
>
> 8) safeguard and secure magnetic disks and other computer storage media containing personnel records; and
>
> 9) dispose of identifiable personnel data in automated files in such a manner as to make the data unobtainable to unauthorized persons. Unneeded personnel data stored on reusable media such as magnetic tapes and disks must be erased prior to release of the media for reuse.

We turn next to the larger federal agencies, almost all of which have some bodies of personal information on clients and have extensive pre-OA experience with following the privacy and security guidelines for handling confidential client information.

3. Large agencies in the midst of developing privacy and security policies

Some larger agencies report that they are in the midst of implementing substantial OA applications involving micros, and are also developing new or applied privacy and security policies to apply in those new applications.

Among the agencies that reported to us that this was their posture were: the Federal Reserve System,[13] Bureau of Labor Statistics,[14] Department of Army,[15] Tennessee Valley Authority,[16] Equal Employment Opportunity Commission,[17] Department of Housing and Urban Development,[18] and Department of the Treasury.[19] Here are reports of three agencies in this situation:

- The Tennessee Valley Authority reports that it is currently defining "in detail" the roles of information systems professionals, end users, and user managements in the security function and the "data resource management function..." "Data ownership and custodial roles were defined in 1982 but are currently being revised to fit the continuum between data that is integrated for agency-wide use and data that is developed independently by (and for) a few users." "Special documents are planned to convey relevant policy and regulation material to novice end users in a suitable form."

- The Bureau of Labor Statistics is introducing end-user computing into its operations in a three year strategic plan, begun in 1984, under an "agency-wide approach." All end-user computers will be able to communicate within the BLS system environment. End-user applications will include word processing, financial analysis and modeling, graphics, text storage and retrieval, electronic mail, conferencing, voice store and forward, activity/project management, data base management, and others, operating through a local area network. All of this is required to be done with Program Managers, MIS officials, and BLS's Office of Technology and Operations Review responsible for complying with existing rules for confidentiality of BLS data. BLS has prepared a Draft Policy Statement on "End User Computing Facilities" which includes the following provision:

  > (4) Proposals to establish data bases must be approved by OTOR. This approval will focus on the technical sufficiency of the proposed design of the data base. All proposals for establishing data bases must include

a designation of an official responsible for the integrity of the data. Integrity includes responsibility for the security and confidentiality of the data, where applicable. (See Commissioner's Order No. 2-80 for BLS policy on the confidentiality of BLS data.)

- The Department of the Army has had one of the federal executive branch's most explicit sets of privacy and security policies and implementing procedures for ADP systems. (These include AR 349-21, "The Army Privacy Program," and AR 380-380, "Automated Systems Security.") These have already been applied to word processors. How to cover micros and PCs is currently caught up in applying a large-scale reorganization of information resources management. The Army reports:

> "The Army is currently reorganizing all of its information resources under a single manager - The Assistant Chief of Staff for Information Management. Prior, separately managed office automation programs are being transitioned into a single Army information management program, which encompasses automation, communications, audio-visual, and records management, to include application of the Privacy Act. Information management plans for this entire area will be developed at all levels; however, since the reorganization is occurring at this moment, no plans are yet available under the new concept."

4. Large agencies with new policies in operation

About a dozen large agencies that we did site visits to, or responded to our inquiry, or about which we obtained information from other sources, took significant actions as to privacy and/or security in OA during 1983-84.

Some of these, such as the United States Information Agency[20] and the Department of State,[21] were dealing with OA applications involving national-security or other sensitive transactional information that would not be "personal client data" in the usual sense of the term. Therefore, we will not go into these actions in further detail, but will focus on settings in which information is maintained about citizens in administering federal domestic programs.

The agencies we examined which have taken significant actions are: Department of Agriculture,[22] Department of Energy,[23] Department of Defense,[24] General Services Administration,[25] Environmental Protection Agency,[26] Office of Personnal Management,[27] Veterans Administration,[28] and Department of Health and Human Services.[29] In varying degrees of specificity and implementation, what these agencies have in common is that they have already:

- o Designated privacy and security requirements for end-user computing or small OA systems in various policy statements, circulars, or guidelines issued by the agency.
- o Assigned specific responsibility for addressing privacy and security requirements to various management, staff, and user groups.
- o Begun providing risk-analysis methodologies and procedures for micro and PC applications, as well as information-sensitivity-classification requirements.
- o Begun direct communication with and education for managers of units acquiring micros and PCs.

We have selected a few of these active agencies to describe in our report.

(1) Department of Agriculture (USDA)[30]

USDA is the fifth largest civilian agency in the federal government in total dollars for information resource management. It is already an extensive user of DP and OA, and expects to have 10,000 micros and minis with on-line capabilities by FY 1987. Its Long-Range IRM Plan, FY 1984-FY 1988 (May, 1984) is a sophisticated and expert document.

USDA's Farmers Home Administration (FMHA) administers a $60 billion loan and grant program to farmers, through a network of 2,200 local offices. It has 2 million loans outstanding to farmers, and its loan and grant application records are filled with sensitive financial, family, and other personal information, including payment histories and delinquencies. The

Farmers Home Administration is involved in computer matching programs to identify fraud and abuse in federal program eligibility, and is also impacted by the Debt Collection Act of 1982, which amended the Privacy Act to permit disclosure of Social Security numbers and other personal information to consumer reporting agencies for debt collection purposes.

FMHA addresses privacy issues throughout its ADP and OA documents. It regards "sensitive borrower records" in FMHA as requiring strong confidentiality, access, audit, and security controls, especially in the OA system being set up for the 2,200 field offices.

As part of the requirements set by its long-rage plan, USDA issued a Departmental Regulation on Microcomputer Policy on May 24, 1984, governing "acquisition and operation of microcomputers in USDA." At the outset, the Regulation defines "Sensitive Systems" to include:

> "Systems which process national security, personal, financial, proprietary, or market-sensitive data..."

It then requires "security considerations" to be part of "requirements, feasibility, and cost-benefit studies" done before all acquisitions. Special requirements are spelled out for micros used in a telecommunication environment; ownership and levels of sensitivity must be attached to data; and other safeguards are specified.

In July, 1984, USDA issued another Departmental Regulation on USDA ADP Security Policy, to set policies and procedures "for safeguarding the Department's ADP resources and protecting the privacy of automated data." Responsibilities are spelled out for the Office of Information Resources Management, agency heads, ADP Facilities Managers, and ADP Security Officers. The Regulation is reproduced in our Appendix, but the following sections on microcomputers are of particular interest to reproduce here:

BACKGROUND

Use of advancing technology and ever-growing dependence on electronic information processing render the Department increasingly vulnerable to abuse and misuse of information resources. The USDA ADP security program is designed to protect the confidentiality and integrity of information; to assure the availability of ADP and WP services, and to afford adequate physical protection to all information resources.

The expanding use of personal computers, distributed data bases, and telecommunications places additional responsibilities on office managers, research personnel, and others not previously considered information processing professionals. No longer can we rely on "the computer center" to protect our operations. Controls must be placed and administered where they are most effective. Local procedures must be developed, documented, implemented, and monitored to assure reasonable and effective management of both traditional and new technology.

POLICY

USDA shall establish and maintain a comprehensive security program to assure adequate protection of ADP resources. The program shall incorporate all applicable laws and Federal and Departmental regulations.

It is essential to assess the sensitivity of data and the sensitivity and criticality of processing; to establish data ownership; and to develop rules for access to programs and data.

Security should be a major determinant in evaluating use of microcomputers or personal computers, particularly in a network environment. Microcomputer systems software is typically rudimentary and affords essentially no protection to data and programs. Establishing ownership of shared data bases in a microcomputer network and maintaining adequate access control, update procedures, and backup present complex problems. Therefore, it is USDA policy that when microcomputers are used to process sensitive information, controls, both technological and procedural, must be used. If adequate security cannot be maintained in this environment, other system configurations should be used.

A final example of USDA's activity was its publication on July 19, 1984 of a 50-page ADP Security Manual. This covers "the security and privacy of all automated information that is collected, transmitted, used, processed, stored, or disposed of by or under the direction of USDA or its designated agent." Microcomputers are defined and covered throughout the Manual, and there are detailed sections on information sensitivity, Privacy Act requirements, and security measures. Two Appendices are particularly excellent: one on "Risk Analysis Procedures" describing USDA's methodology and techniques in detail, including micro applications, and a second on "Certification and Recertification of Application Systems," specifying an In-House Team approach for this process. Privacy as well as security threats are very well treated in these discussions. (We reproduce the "Risk Analysis" Appendix in our own Appendix.)

Having treated USDA in detail, we will provide briefer profiles of other active federal agencies.

(2) Veterans Administration[31]

The Veterans Administration, with millions of sensitive records on the service and medical histories of veterans, is developing extensive headquarters and local-office applications of OA. It has specified data privacy and security as among the elements that officials desiring to implement end-user computing must take into account. It has also written a chapter on "Office Computers" that indicates that VA units must comply with the Privacy Act, Paperwork Reduction Act, and GAO and OMB security guidelines, and issued a "Circular" in August of 1984 that makes those concerns ones that must be met in the evaluation phase of office systems. Finally, it has included security requirements in the RFP's it has issued to vendors offering office systems. The security requirements specify:

C.1.3.3. SECURITY

C.1.3.3.1. The shared systems must provide a security function capable of precluding unauthorized access to a given document, file, drawer, library, or volume. The security function must be such that, if no protection is desired for a given document, no special action is required. If a library, drawer, file, or volume is protected, all documents entered into that library, drawer, file, or volume will be protected. The shared systems must provide a means accessible only to the system supervisors to print or otherwise bypass any operator-generated passwords.

C.1.3.3.2. The shared systems must provide facilities for password protection for log on and file access security. If password protection for data files is handled differently from that for documents, at least the same level of protection must be available for data files as for documents.

C.1.3.3.3. When operators log on the shared systems, operator passwords must not be viewable on the display screen.

C.1.3.3.4. The shared systems must include a security function that does not allow one user to change or view the code of another user's program files or data files unless authorized. The shared systems must provide a means accessible only to the system supervisors to override these security restrictions.

(3) Department of Energy (DOE)[32]

The Department of Energy is also one of the five largest users of ADP systems in the federal civilian sector. It has had in place for five years a detailed Computer Security Program for Unclassified Computer Systems (DOE Order 1360.2, March 9, 1979), DOE's response to OMB's Circular A-71 requiring computer security measures of all federal ADP users. DOE recently issued an ADP Internal Control Guideline (DOE/MA-0165, August, 1984) that updates its 1979 policies, specifically including office automation. Of particular interest in this lengthy manual is a vulnerability assessment questionnaire relating specifically to microcomputers and a set of "control techniques" for microcomputers.

In addition, we have seen drafts of two DOE documents that will be issued shortly: Management of Microcomputers and Word Processors, which treats confidential and sensitive unclassified information and Privacy Act information in detail; and Security Guidelines for Microcomputers and Word Processors. The latter is one of the best guide books we have seen for local managers and end users.

(4) Office of Personnel Management (OPM)

OPM does not have a broad office automation network, but rather microprocessors serving as stand-alone workstations for office word processing and related support. What is interesting among OPM policies and procedures on privacy and security is a recent Administrative Manual System Letter sent to all heads of OPM offices, on "Microcomputer Security," dated October 23, 1984. This letter is a short, clearly presented brief designed to sensitize local managers to the basic security issues, and to indicate where further expert help can be obtained within OPM.

G. Comparing the federal and private sectors

Our research indicates that the federal sector is well ahead of the corporate and non-profit sectors in applying privacy rules and issuing detailed security guidelines for micro uses and OA applications. On the privacy side, this reflects the institutionalization of Privacy Act administration over ten years -- a detailed statute; OMB guidelines; agency implementation rules; annual reporting requirements for agencies; designated Privacy Act officers; etc. This institutionalization is reinforced by the continuing attention given to data privacy issues in federal agencies by Congressional committees, the media, interest groups, and legal/academic scholars. In one sense, the arrival of micros and PCs -- once the potential privacy and security impacts were recognized -- has begun to receive the predictable response of a bureaucratic system with in-place law and organizational mechanisms to apply.

On the security side, the same institutionalization applies. OMB, GSA, and NBS guidelines play a stimulative role, and there is strong and individual-agency expertise in information technology and information resources management to apply to new security problems. The federal system functions as more of an entity in this regard than is true of the private sectors, even within particular industries with sensitive client data. Our contacts with banks, brokerage houses, insurance firms, hospitals, and educational institutions in 1983-84 found these sectors as a whole behind the federal executive branch as a whole in issuing new policies, guidelines, or beginning internal education. Furthermore, comparing leading-edge private organizations with the leading federal agencies we have described shows the federal agencies to be well ahead.

5. POLICY ANALYSIS

Clearly, we are on the early frontier of microcomputer use in organizations. But American society has learned that engaging in early technology-impact studies and assessments is vital if we are to recognize potential benefits and dangers early enough to apply wise interventions -- or to decide that no special interventions are needed and existing market mechanisms, laws, and organizational rules are adequate for the near future. We turn now to such an assessment, drawing on the empirical probes that we have presented in this report.

5.1 Future directions of micro use in office work

For the purposes of our topic -- privacy and security of client data -- three significant technological trends seem to be under way. First is the growing capacity to connect stand-alone word processors, micros, and PCs to intra-organizational data bases and other terminals. While there will be a period in which terminals designed solely for stand-alone use will have to be modified or replaced, the trend for the rest of the 1980s will be that most existing and all new VDT/CRT type terminals will have on-line connectability as a basic feature. Presumably, new types of display technologies will offer the same capability.

A second trend is the proliferation of various kinds of external electronic networks to which micros and PCs used inside organizations will be able to communicate. These include inter-organizational electronic mail systems (private or through the U.S. Postal Service); inter-organizational ("industry") databases (in law enforcement, insurance, credit, etc.); voluntary-association networks and "bulletin-board" computer clubs; and similar systems.

The third trend is the fusion of voice and data capacities at the end user's desk. Whether the new voice/data terminals currently being marketed prove attractive in terms of cost-effectiveness and user-acceptance in the near future or whether separate voice and data devices will prevail for some years to come is not yet clear. However, increased mixtures of voice and data capabilities at the desk of the end user seem assured, whatever specific devices are used to perform these functions.

5.2 Are these trends likely to be widely implemented?

The three technological trends we have noted are all ones that appear ready for organizations to take up and use in the coming years, and there seem to be clear market and organizational-effectiveness reasons for them to do so. Connecting end-user terminals to internal and external information sources and networks is not like pursuing large-scale "databank concepts" for managing client services, where variable relationships, casualty theories, and privacy/confidentiality constraints still make such organizational adventures chancy and controversial. Rather, connecting most knowledge workers in organizations to a wide range of database and communication opportunities offers high positive opportunities for improving knowledge work, assuming that privacy and security considerations can be met. Therefore, we believe that the likely technological capabilities will be actively adopted by leading business, government, and non-profit users, and will become mainstream applications.

5.3 Overall implications of these trends

The overall implication of these three likely trends is that large numbers of end-users in organizations -- perhaps most professionals and managers by the end of the 1980s -- will have terminals on their desks or available in their work areas not only for stand-alone uses but also to communicate with other end users, access intra-organizational databases, and access external databases and networks. How to control access and misuse of these on-line capabilities by end-users will be a key privacy concern. And, if combined voice/data terminals proliferate, there will be important privacy of communication and room-eavesdropping potentialities to safeguard against, as we discussed on pages 48-49.

5.4 What policy issues do the present and predicted uses raise?

What policy issues as to privacy and security of client data are raised by these potential exposures, and by the early experiences with end-user OA that we presented is Section 4?

5.4.1 Privacy policy issues

It is critical to distinguish the privacy issues generated by the transition from manual/EAM record systems to EDP systems, in our 1960-1975 baseline period, from the current progression from EDP to OA. As we observed, the impact of the arrival of EDP was a revolutionary increase in two areas: (1) *data collection capacities* (reducing cost and time constraints, magnifying data analysis capabilities, etc.), and (2) *data-sharing capacities* (circulating personal data within and between organizations).

The response of society in privacy laws and organizational codes was (1) to *increase the visibility of organizational activities affecting sensitive personal data* (changing these from private "kitchen work" to public notices and descriptions, with specific rights of data-subject inspection challenge); (2) to stipulate broad *relevancy and social-acceptability standards* for data collection; and (3) to provide *rules for confidentiality or data-sharing*.

Our sense is that the present uses being made of micros and PCs in the office have the following privacy impacts:

- They do not significantly increase the scope of data collection capacities of organizations over existing EDP systems. However, they require organizational managers to provide greater education and oversight of end-users, to see that they know the limitations on data collection set by law or code, and do not violate these in "personalistic" data recording.
- They do increase the risks of improper circulation of personal client (or personnel) data within the organization and to outside organizations. This is because they provide greatly increased numbers of organizational employees with a tool to access and distribute confidential client data.
- They do increase due process problems. To the extent that stand-alone diskettes and off-line storage of personal client data would not be known to data subjects, its uses for decision making by that end-user could not be challenged under privacy rules for subject access.

As our analysis suggests, however, what seems called for is not the enactment of new laws or writing of new organizational codes of privacy protection but the application of existing rules to the new settings of end-user OA. Here, it does not seem to us to matter whether organizations adopt the view that micros and end-user OA are part of a unified information resource or integrated office (as we noted some federal agencies are saying) or whether micros and end-user OA are treated as separate or distinct components of office activity. The critical element is to apply existing privacy protection rules to predictable oversights, carelessness, or misuse by some persons in the large, end-user populations, and to assign organizational responsibility and continuing oversight duties to effective units at various levels of the organization.

A good way to test this policy judgment is to apply it to current privacy debates involving federal information activities:

- As to data collection, the Reagan Administration has not sought to create new databases on dissenters, radicals, or critics, in the Johnson/Nixon era style. And, where questions about applying databank methods to new groups have been raised -- as with FBI plans to create files on white collar crime suspects or to access private-sector credit and mailing-list records -- these are clearly database-oriented mainframe and mini applications, not proposals that would be made possible or even facilitated by stand-alone micro and PC capabilities.

- On confidentiality, the Reagan Administration has generated privacy debates over its extension of computer matching programs and over legislation such as the Debt Collection Act of 1982 allowing release of debtor information from agency files to private consumer credit and collection agencies. Those also are central database activities, and are neither made possible nor particularly facilitated by micros.

  Beyond those areas, the Reagan Administration's private-business orientation, its concern over unauthorized leaks of information from federal agencies, and its desire to limit the sweep of some federal freedom of information act disclosures all make Reagan-appointed agency managements quite interested in protecting the confidentiality of identified client data from unauthorized disclosure.

- On subject-access, many of the same Reagan Administration values and attitudes just mentioned apply, especially where access by taxpayers, business, and other groups to their files and the agency decision-making process is involved. Where privacy debates have arisen is over efforts to limit access to intelligence and law enforcement record systems; this is more an FOIA than a Privacy Act issue (because of Privacy Act exemptions for such files). It is also not an issue on which data held in stand-alone micros is significantly involved.

A final test would be whether stand-alone micros or end-user OA is involved in the plans of major federal agencies for modernization and expansion of their data systems and information resources. Examples of these questions were the Tax Administration System of the IRS and the Future Process System proposed by Social Security during the 1970s, and the FBI's Triple I system for a national criminal history system today. The critical issues here involve the initial scope of such systems; their amalgamation of data from various sources presently kept separate; their ability to install and maintain various confidentiality and due process interests; and larger political questions as to assuring equity in program administration and providing adequate Congressional and public information and participation in the design and operations of such proposed systems. All of these policy questions are at the database level. While assuring enforcement of the privacy rules arrived at in the activities of end-users with micros and PCs would be an important implementation concern, that aspect would not be a fundamental policy issue.

5.4.2 Security policy issues

In the *private* organization world in the United States, we found *general agreement among DP and OA staff* by the end of 1984 that there are significant security exposures in using micros and PCs in organizations, not just for sensitive client and personnel data but also for proprietary business information, financial data, national security information, and legally-sensitive information. This sense has not been taken up yet by most top managements, and thus the policy directives and budget authorizations necessary to address this problem adequately have not been present to many private-sector organizations. We believe this is less true of the federal government, and in some leading state governments with strong privacy statutes and skilled EDP staffs. Even here, however, some DP and OA staffs have not done all that is required. As one DP director in a federal agency commented to us: "The issues of data security and privacy are largely ignored [in this agency]. I concede that those of us in the DP community may be at fault for not being more persuasive in focusing the attention of both the users and senior management on them."

When it comes to security measures needed to safeguard sensitive client data in micros and end-user OA, our survey of computer security experts and

and our site visits show that (1) the techniques for installing security protections are well known; (2) the process of risk-assessment and vulnerability analysis to determine cost-beneficial policies is well known; but (3) so far, these techniques and processes have just begun to be undertaken in the private sector, and are somewhat further advanced in the federal establishment. Therefore, the central task in the security area is to obtain the organizational directives and resources with which to apply known techniques and processes, not to identify wholly new security approaches or methodologies.

If this is done, there will obviously be some specific situations in which micro uses will require special treatment. For example, if combined voice/data terminals are widely used, there might have to be manufacturer responsibilities for preventing undetected turning on of the microphone capabilities of individual terminals, and security checks might be needed to insure that neither officials within the organization nor outside hackers or more serious intruders used these terminals for organizational espionage.

5.4.3 Corporate Liability for Breaches of Privacy and Security

In considering possible liability for companies should confidential personal information be disclosed improperly from micro or PC equipment, the important legal principle to recognize is that the nature of the storage or processing unit is not a determinative element in assessing liability. Whether a legal duty to safeguard confidential personal information has been violated will depend on whether a statutory obligation, a common law duty, or a contractual obligation not to disclose personal data to certain parties or in a certain manner has been violated. If such a duty exists, the data holder will be liable whatever the storage or processing system that was used. If no such legal obligation has been violated, then there is no confidentiality breach that is actionable at law just because personal data was handled in OA systems rather than EDP or manual systems.

However, in examining whether the security measures that the data holder took to prevent breaches of confidentiality were reasonable or not (under common law duties) or met defined statutory standards of security (where these may exist), courts will look to the prevailing customs and practices of security in a given type of data system, and use such a "state of the art" inquiry to determine if reasonable care had been exercised. In such an inquiry, the known incidence of young hackers attempting to penetrate systems could be taken into account by a court and used to define (a) the known risk that should have been anticipated and countered, and (b) the kinds of reasonable safeguards that managers of other data systems were taking (at generally acceptable costs).

What this suggests is that future lawsuits for improper or negligent disclosure of confidential personal data from OA-oriented systems will be tried by courts under a two-fold test:

- o Was there a legal duty of confidentiality, and, if so what were its terms?
- o Were the security measures adopted to forestall such disclosure reasonable or not, given experience and the state of the art in security techniques?

6. CONCLUDING PERSPECTIVE

In the EDP era, computing and telecommunication power was provided to organizational managers, specialized professionals, and small, highly-supervised staffs of data entry and customer-service personnel. Now, we have entered the age of "computing power to the organizational masses." We do not yet know where this revolution in computing resources will take organizations, or just how it will affect the tens of millions of knowledge workers who will be using these tools. What we have to assume is that the extension of computing power will be used with all the diversity of good and bad motives, pursuit of self-interest and the public-interest, and in compliance with or defiance of organizational rules that has characterized the behavior of organizational leaders and employees in the ages of manual and EDP-assisted record keeping. A prudent democracy, to echo John Adams on the rule of law, does not leave such behavior to faith in the goodness of human nature, but seeks to "bind it down" in the "chains of good policy."

APPENDIX

A. Project Survey Administered at Computer Security Institute, November, 1984.

ANONYMOUS SURVEY ON SECURITY AND PRIVACY IN OFFICE AUTOMATION ENVIRONMENTS
11th Annual Computer Security Conference — 1984

Professors Lance J. Hoffman (George Washington University) and Alan F. Westin (Columbia University) have been retained by the U. S. Congress' Office of Technology Assessment (OTA) for a project reporting to Congress on security and privacy issues, practices, and experiences in office automation (OA) applications. This covers the use in offices of stand-alone word processors and personal computers as well as situations in which inexperienced end users are being given terminals linked to mainframes or distributed central processors. We would be grateful if you would fill out this ANONYMOUS QUESTIONNAIRE to help provide OTA with data and opinions. Please circle the appropriate response or fill in the blank for each question. A report on the results of the survey will be published in one or more Computer Security Institute publications.

PART ONE

1. What is your job function?

1 (1) Auditing (2) Security Officer (3) General Management (4) DP Management
(5) Planning/Analysis (6) Research/Engineering (7) Programming (8) Other

2 3 2. How long have you had computer security responsibilities? ______ years

3. What type of organization do you work for (check one):

(1) Civilian government agency (2) Military government agency
4 5 (3) Business or professional corporation (4) University
(5) Non-profit (please indicate type: ______________)
(6) Other, not consultant (please indicate type: ______________)
(7) Independent consultant (please skip to Part Three)

6 4. How many employees are in your organization? (Check here ( ) if you are reporting on a sub-unit of a larger organization.)

7 (1) under 500 (2) 500-1000 (3) 1,000-10,000 (4) over 10,000

5. How would you classify your organization's general position as an information technology user? (Please check one judgment for each type of technology.)

TYPE OF TECHNOLOGY	Mainstream User	Highly Advanced, Overall	Advanced in Some Areas	Behind the Mainstream, Overall
8 Traditional EDP Systems	☐	☐	☐	☐
9 Telecommunications	☐	☐	☐	☐
10 Office Automation (OA)	☐	☐	☐	☐

6. What function or group in your organization has the most decisive voice in adopting overall office automation plans and policies?

11 12 ____

7. If you could add one security or privacy policy for the OA environment that is not currently in place in your organization, what would you want to see done?

13 14 ____

____

PART TWO

8. Below is a list of some security or privacy policy or safeguard measures which hav been applied in traditional EDP environments. If your organization currently applie any of these in office automation applications using personal computers or wor processing equipment (not "dumb terminals"), please indicate so in the space provided.

a. Physical security and media control

15 ___Computer system physically secured
16 ___File cabinets locked up
17 ___Paper documents locked up
18 ___Forms locked up
19 ___Diskettes locked up
20 ___Searches at exits for unauthorized removal of media such as floppy disks
21 ___Sensitive documents labeled by system with classification or warnings at top or bottom of pages
22 ___Protection against unauthorized duplication of programs or data

b. Technical measures

23 ___User identification required
24 ___Some functions require password
25 ___Data integrity (out of range data, etc.) checked
26 ___Cryptography used
27 ___"Anti-hacker" call-back device used
28 ___Logging (journaling) done
29 31 ___Other #1 (please specify) ______________
32 34 ___Other #2 (please specify) ______________

c. Security and privacy awareness

35 ___Training program
36 ___Ongoing risk analysis program
Privacy guidelines for:
37 ___salary data
38 ___medical data
39 ___financial data
40 ___strategic planning data
41 43 ___other (please specify: ______________)

9. Do office automation users in your organization receive any of the following o security and privacy issues:

		Yes	N
44	Education about security and privacy in user training?	☐	☐
45	Policy statement on security and privacy?	☐	☐
46	Discussion of security and privacy in organization newsletters or other periodic communications?	☐	☐
47	Informal discussions of user responsibilities by security officer	☐	☐
48	Informal discussions of user responsibilities by supervisor	☐	☐

10. Has your organization conducted within the past two years or are there current plan for any of the following:

		Done Within Past Two Years	Currentl Planned
49	Formal survey of OA security/privacy practices and conditions	☐	☐
50	Risk analysis of OA security practices	☐	☐
51	Audit of OA security and privacy practices and conditions	☐	☐

		Yes	No
52	11. Does your organization use any monitoring of individual operator keystrokes or transaction volumes to determine pay, bonuses, performance evaluation, or promotions?	☐	☐
53	Have any employees raised concerns about this as "Big Brother" monitoring?	☐	☐
54	If your organization is union-represented, has this issue been raised by the union?	☐	☐
55	Does your organization have a formal policy on how individual operator work monitoring should be conducted?	☐	☐

12. What percentage of personal computers in your organization are currently able to:

		0-25%	26-50%	51-75%	76-100%
56	download data from a central site?	☐	☐	☐	☐
57	update data at a central site?	☐	☐	☐	☐

13. Has anyone in your organization ever been subject to disciplinary action after a security breach? If so, check all that apply.

58 Someone was (1) warned (2) suspended (3) dismissed.

14. How many CRT/VDT terminals would you estimate there are in your organization?

59 62 ____________ Of these, what percentage are in office applications?

63 (1) 0-25% (2) 26-50% (3) 51-75% (4) 76-100%

15. Roughly, what percentage of each occupational group listed below would you say have their own terminal, word processor, or personal computer — or share one — for regular work? (Check one box only on each line.)

		0-25%	26-50%	51-75%	76-100%
64	Data entry operators	☐	☐	☐	☐
65	Customer service personnel	☐	☐	☐	☐
66	Secretaries	☐	☐	☐	☐
67	Professional/technical	☐	☐	☐	☐
68	Managers	☐	☐	☐	☐
69	Senior executives	☐	☐	☐	☐

16. In your organization,
has any insider leaked to an outsider:

		Yes	No
70	computer-based personal data about clients/customers?	☐	☐
71	computer-based personal data about employees?	☐	☐
72	computer-based business or proprietary data?	☐	☐
73	has any outsider obtained computer-based confidential data without inside cooperation?	☐	☐
74	has there been any violation of organizational security or privacy policy by OA users?	☐	☐

17. If you answered "yes" to any item in the previous question, please describe the most significant incident briefly.

PART THREE

18. From your experience as a computer security professional, please indicate your agreement or disagreement with the following brief statements of opinion. (If you have no opinion or don't know, please leave the line blank.)

		Strongly Agree	Agree	Neutral	Disagree	Strong Disagr
75	a) Senior management in my organization is aware of security and privacy concerns in office automation.	☐	☐	☐	☐	☐
76	b) Senior management is giving adequate financial support to providing office automation (OA) security and privacy measures in my organization.	☐	☐	☐	☐	☐
77	c) It is significantly harder to apply security and privacy measures in the OA environment than in traditional EDP areas.	☐	☐	☐	☐	☐
78	d) Periodic, unannounced searches of end-user personal computer disks as essential to enforce security and privacy policies in the OA environment.	☐	☐	☐	☐	☐
79	e) Proliferation of personal computers is leading to lower compliance by managers with government privacy regulations such as the Fair Credit Reporting Act, employee privacy laws, Federal Privacy Act, etc.	☐	☐	☐	☐	☐
80	f) In general, civilian federal agencies are probably ahead of the private corporate sector in applying security and privacy measures to OA.	☐	☐	☐	☐	☐
81	g) The spread of electronic mail/message systems poses real problems in restricting confidential information to those with a need to know.	☐	☐	☐	☐	☐
82	h) The OA environment allows more people to have physical access to work stations and disks to which they are not authorized than was true in the earlier EDP environments.	☐	☐	☐	☐	☐
83	i) There is a trend for broader or more detailed personal information to be collected about clients or customers as a result of inexpensive, decentralized OA.	☐	☐	☐	☐	☐
84	j) There is a trend for broader or more detailed personal information to be collected about employees as a result of inexpensive, decentralized OA.	☐	☐	☐	☐	☐
85	k) There is currently no need for a uniform federal computer crime law; state laws are adequate.	☐	☐	☐	☐	☐

THANK YOU VERY MUCH FOR TAKING THE TIME TO FILL THIS OUT. Please hand in at the Registration Desk. (If you fill this out after the end of the conference, please mail to Prof. Lance J. Hoffman, Department of Electrical Engineering and Computer Sciences, The George Washington University, Washington, D. C. 20052)

B. Alan F. Westin article on privacy protection developments, 1960-1983.

NEW ISSUES OF COMPUTER PRIVACY IN THE EIGHTIES

Alan F. WESTIN
Professor of Public Law and Government
Columbia University,
729 International Affairs Building, New York, New York 10027, USA

Invited Paper

The paper first defines what functions privacy performs in democratic societies, and the different levels -- individual, social, and political -- at which balances of privacy are set. This is followed by an account of how early alarms were raised about threats to privacy from EDP systems in the 60s, and how effective privacy protections were enacted in most Western democratic nations, in the 70s and early 80s. The paper concludes by assessing how these principles of privacy protection can be applied to five major areas of new EDP applications in the Eighties.

1. INTRODUCTION

Advanced industrial nations are now deep in the third decade of the computer's steadily-expanding impact on individuals, organizations, and societies. In this paper, we will explore how Western democratic nations have perceived and dealt with the "computers and privacy" issue during the past 25 years, and what new privacy issues are being posed by major technological and social trends in the 1980s.

2. BASIC DEFINITIONS AND OPERATIVE CONCEPTS RELATING TO PRIVACY

Almost all definitions of privacy agree on a core concept: that privacy is the claim of an individual to determine what information about himself or herself should be known to others. This also involves when such information will be communicated or obtained, and what uses will be made of it by others. In addition, many definitions of privacy -- my own included -- would add a claim to privacy by groups and associations as well as individuals, and also a limited (largely temporary) right of privacy for government bodies as well.

When we examine how the norms of privacy are set in any society, we need to have in mind three settings: the political, the sociocultural, and the personal. (1)

At the political level, every society sets a distinctive balance between the private sphere and the public order, based on the political philosophy of the state. In authoritarian societies, where public life is celebrated as the highest good and the fulfillment of man's purpose on earth, the concept of legally or socially protected privacy for the individual, family, social group, and private association is rejected as hedonistic and immoral. It is also politically dangerous to the regime. Such governments keep extensive records on people to watch for "deviationist" behavior and use a wide range of physical surveillance techniques to watch and listen secretly to elite groups. In contrast, constitutional democracies, with a strong commitment to individualism and freedom of association, regard the private sector as a major force for social progress and morality. The public order, government, is seen as a useful and necessary mechanism for providing services and protection, but one that is expressly barred by bills of rights and other guarantees of civil liberty from interfering with the citizen's private beliefs, associations, and acts, except in extraordinary situations and then only through tightly controlled procedures.

This political balance is the framework for a second level of privacy -- the sociocultural level. Environmental factors, such as crowded cities, and class factors of wealth and race shape the real opportunities people have to claim freedom from the observation of others. In this sense, privacy is frequently determined by the individual's power and status. The rich can withdraw from society when they wish; the lower classes cannot. (Ironically, though, the rich, the famous, and the politically powerful are also the people whose efforts at privacy are the most assaulted by the media, political rivals, government investigators, etc.)

At the sociocultural level, privacy is closely related to social legitimacy. When a society considers a given mode of personal behavior to be socially acceptable -- whether it is hair style, dress, sexual preference, political or religious belief, having an abortion, or other lifestyle choice -- it labels such conduct as a "private" rather than "public" matter. This generally means that such matters should not be inquired into for the purpose of denying someone access to the desirable benefits, rights, and opportunities controlled by government or private organizations. When society does not accept certain personal conduct, but considers it socially dangerous, society is saying this is not a matter of "private choice" and does not allow the claim of privacy to be exerted for it in settings where benefits, rights, and opportunities are being distributed. Thus debates over privacy are tied to changes in the norms of a given society as to what kinds of personal conduct are regarded as beneficial, neutral, or harmful to the public good.

Finally, within the political and sociocultural limits just described there are levels of privacy set by each individual as he seeks an "intrapsychic balance" between his needs for privacy and his needs for disclosure and communication. This balance is generally a function of one's family life, education, and psychological makeup and reflects each individual's particular needs and desires.

The extent of personal privacy varies, but there are four conditions that can be identified. Sometimes the individual wants to be completely out of the sight and hearing of anyone else, in solitude; alone, he is in the most relaxed state of privacy. In a second situation the individual seeks the intimacy of his confidants -- his family, friends, or trusted associates with whom he chooses to share his ideas and emotions. But there are still some things that he does not want to disclose, whether he is with intimates or in public. Either by personal explanation or by social convention, the individual may indicate that he does not wish certain aspects of himself discussed or noticed, at least at that particular moment. When his claim is respected by those around him, he achieves a third condition of privacy, the state of reserve. Finally, an individual sometimes goes out in public to seek privacy, for by joining groups of people who do not recognize him, he achieves anonymity, being seen but not known. Such relaxation on the street, in bars or movies, or in the park constitutes still another dimension of the individual's quest for privacy.

In all these states of privacy the individual's needs usually change from time to time. At one moment, he may desperately want to be alone. At another, aloneness can be so frightening that he desperately seeks the companionship either of an intimate friend or of a complete stranger, a one-time acquaintance who will listen to his problems but who will not be encountered again.

The fundamental element of choice involved in personal privacy is embodied in every definition of privacy used today in law, social science, or common understanding. With some variation, as we noted, these definitions all agree that privacy is the claim of an individual to determine for himself whether and how he will communicate with others -- what he will reveal, when, and to whom.

The importance of the right to choose, both to the individual's self-development and to the exercise of responsible citizenship, makes the claim to privacy a fundamental part of civil liberty in a democratic society. Without the power to decide when to remain private, we cannot exercise many other basic freedoms. If we are switched "on" without our knowledge or consent, we have lost our fundamental rights to decide when and with whom we speak, publish, worship, and associate. We have been made glass people.

So far, we have stressed the importance of privacy to the individual in a democracy. But every society must also provide for the disclosure of information necessary to the rational conduct of public affairs and must engage in some surveillance of individual and group activity in order to control illegal or antisocial acts. From the earliest periods of Western society, these disclosure-surveillance functions have been vested in five authorities: the employer-landlord; the church; the heads of other associations to which the individual belongs; local governmental officials, and the national regime. In every historical era, as conflicts for primacy raged between church and state, town and guild, or king and baron, the individual's immunity from unwanted surveillance or disclosure has been a part of these basic power struggles.

In fact, looking back over 2,000 years of Western political history, we can identify two basic patterns of privacy and disclosure-surveillance. In the authoritarian tradition -- exemplified by Sparta, the Roman Empire, early France, and modern totalitarian regimes -- unlimited or very extensive powers to compel disclosure and carry on surveillance have been an essential part of the system. In the libertarian tradition -- typified by Periclean Athens, the Roman Republic, the English parliamentary system, the American republic, and modern democratic nations -- basic limits have been placed on the powers of the authorities to put individuals or groups under surveillance or to compel their disclosure of information considered private or privileged. While the issue of privacy is complicated historically -- it has often been enmeshed in rival claims to power by the contesting authorities -- it is fair to say that no political system with a reputation for liberty in its time failed to provide important legal and social limits on surveillance by authorities.

It is in these contexts that the use of computer technology unfolded in Western industrial nations between 1955 and the present, and gave rise to the "databank" or "computers and privacy" issue.

3. THREE MAJOR PHASES OF THE COMPUTERS-AND-PRIVACY DEBATE

3.1 Phase One: The Era of Early Alarms, 1964-1969

In the early 1960s, alarms were sounded in many nations over the new technological threats to the ability to be "let alone." While some of the fears involved the micro-miniaturized listening and watching devices for putting people under physical surveillance, and others concerned improved sensors for reading people's emotional states and psychological outlooks, the deepest concerns about privacy in this phase focused on the computer and telecommunications, with their tremendous capacity to collect, store, process, and distribute personal data. Both popular and scholarly commentators warned that computerization threatened privacy by making it possible to collect more detailed and sensitive personal data about people than had been feasible or cost-effective previously; by making it easier to exchange data among computerized organizations; and by facilitating the creation of secret files and information flows about people.

This warning literature surfaced in almost every advanced industrial nation. For example, there were books in the United States such as The Privacy Invaders (1964) and my own Privacy and Freedom (1967); in Britain, The Data Bank Society (1970); in Australia, The Private Man (1969); in France, Privacy and the Law (1971); in the

Netherlands a book with the dramatic title of Data Bank or Data Beast (1973); in Japan a book called The Crisis of Privacy (1973), published in Tokyo by a group called "The Central Conference to Oppose the National Code Number System and to Protect Privacy"; in West Germany, Databanks and Personal Rights (1972); and in Norway a study called Government Data Banks and Protection of Personal Privacy (1972). The warnings also came from parliamentary investigations into invasions of privacy in a dozen nations, from privacy conferences sponsored by UNESCO, the U.N.'s Human Rights Commission, the Nordic Lawyers' Association, and many other groups and agencies.

3.2 Phase Two: The Move to Empirical Studies -- and What They Found, 1969-1972

Then, in the early 1970s, government commissions and private scientific inquiries were set up in many nations to investigate the real dimensions of what was by then called "the databank problem." Canada set up a task force on computers and privacy under its federal departments of justice and communications. Sweden convened a committee on public access, secrecy, and privacy. The French Conseil d'Etat prepared a report in 1970, as did a Justice Department Committee in Finland in 1972 and a Danish Government Commission in 1973. In the United States, the National Academy of Sciences conducted a three-year empirical study of how databanks were affecting citizens' rights, and a task force was convened by the federal department of Health, Education, and Welfare. Similar inquiries were conducted by parliamentary committees in Britain, Norway, the Netherlands, and West Germany, and by the OECD.

Virtually all of these studies came up with similar findings. They concluded that computerization of personal records and files by organizations had not yet created the revolutionary effects in the scope of data collection about individuals, exchange of data among organizations, and secretive uses of files that the alarm-sounders of the 1960s had assumed to be already taking place. The reports were careful to note that computers could do such things, in terms of their technical capabilities. However, a combination of factors were placing practical limits on such uses: high costs for automation of records, an emphasis on computerizing (for cost-effectiveness) of the most objectively worded and frequently used data in organizations, the presence of strong opposition by bureaus and departments within large organizations to have "their" data put into someone else's central databank, the existence of some legal prohibitions, and concerns by managers themselves about how "data subjects" might react to "blue sky" centralized databank schemes.

Furthermore, the studies of the early 1970s concluded that the key privacy or civil liberties issues involved in record-keeping were not basically matters of technology -- computer files instead of paper folders -- but questions of social policy: What information about people should an organization collect to carry out a socially approved function? With whom should it share that information, inside the organization and to others outside it? When should individuals have the right to know that a record existed about them in an organization's files (computerized or manual) and with what rights to inspect their records and challenge the accuracy, completeness, or relevance of the information contained there?

The studies generally agreed, however, that computers and telecommunications do facilitate some important increases in efficiency in organizations, and pose new problems of legal controls. Computerization facilitates the standardization of records, the growth of large-scale data bases, and the development of regional, national, and international networks. They speed up data collection and transmission. And they lead most organizations to make more extensive use of their information once collected. Thus the study groups of the early 1970s agreed that advanced industrial nations needed to develop a combination of new organizational policies and public regulations to strengthen rights of privacy and confidentiality in large-scale personal data systems, and especially the computerized ones. As Michel Poniatowski, the French Minister of State and of the Interior put it in 1974:

> "For several years now, in France as well as abroad, legislative and regulatory programs have been proposed but rarely adopted. We have now arrived at the state where we have to choose and decide . . . Clear rules should determine the conditions of creation, use, and control of files pertaining to individuals."

3.3 Phase Three: Entering the Era of National Regulation, 1973-1983

By the early to middle 1970s, the choices had begun to be made, and the trend toward installing national data protection laws has been unfolding steadily in the past ten years. Classified broadly, three main trends have developed: data protection registries and commissions (the continental European model); fair information practices standards and judicial enforcement (the U.S. model); and non-legislative declarations of good practice (the British model). Each of these merits a brief description and some comparison.

3.3.1. Data Protection in the European Model

Beginning with the Swedish Data Protection Law enacted in 1973, European nations such as the Federal Republic of Germany, Denmark, France, Norway, Austria, and Luxembourg have adopted national data protection laws that are addressed to the placing of personal data in computerized files.

For example, Sweden's national Data Act of 1973 created a nine-member Data Inspection Board, its members appointed by the King. All private automated systems of personal data must be registered and obtain licenses to operate, as well as all government databanks (except those operated by the parliament or the executive, and these too must be carried out "in harmony" with the Data Inspectorate's policies). No databank will be licensed if the Inspectorate concludes there is reason to expect that there would be "undue intrusion" into the privacy of the persons covered. The Data Inspectorate sets security standards for automated systems, regulates transfers between automated and manual systems, and serves as what the Swedes call a "wailing wall" to receive complaints from anyone who feels that the data law is being violated in their case. Sweden's law makes it a crime to commit "data trespass," -- entering a data system without authorization to obtain its data, or attempt to alter or destroy it. The punishment is up to two years in jail. Amendments to the Swedish law in 1979 and 1981 have strengthened some protections of the data subject (for example, by giving the individual a right to be told by a databank keeper that no data about him is being kept in that system) and also simplified the procedures for databanks registration once they meet standards published by the Data Inspection Board.

3.3.2 Data Protection Without National Legislation

At the other pole have been nations such as Great Britain, Greece, Ireland, and others, in which there has been no national legislation and no major court decisions. Protection of privacy in Britain, for example, has been pursued through the enunciation of voluntary codes of good practice to be followed by organizations using computers; during the 1970s, these have been drawn up by parliamentary groups such as the Younger Committee on Privacy, local government associations such as the Local Government Management Services and Computer Committee (LAMSAC), and various private legal and computer societies. The Ten Principles issued by the Younger Committee include injunctions such as these:

- Information should be regarded as held for specific purposes and not be used, without appropriate authorization, for other purposes.
- Access to information should be confined to those authorized to have it for the purpose for which it was supplied.
- The amount of information collected and held should be the minimum necessary for the achievement of the specified purpose.
- There should be arrangements whereby the subject could be told about the information concerning him.
- Care should be taken in coding value judgments.
- In the design of information systems, periods should be specified beyond which the information should not be retained.

Currently (1983), following recommendation of a Home Office Committee on Data Protection in 1978, the British Government has proposed a "minimal" law creating a databank Registrar, controlled by the Home Office rather than operating as an independent body. However, it is not clear whether this legislation will be enacted, and Britain remains therefore an example of a country without national privacy protection laws, relying upon self-regulation by databank operators.

3.3.3 The U.S. Model: Fair Information Practices Judicially Enforced

Between the detailed licensing supervision of the continental European nations and the voluntary-standards approach of Britain is the United States, which has enacted national and state privacy protection laws in some specific areas of record keeping (credit reporting and banking, for example) and a national law (the Federal Privacy Act of 1974) creating "fair information practices" rules for all federal agencies keeping personal data in any form, manual or computerized. The 1974 law requires U.S. federal agencies to disclose their information activities, justify their collection and use of data in public proceedings, and give data subjects a right of access to almost all of their records. Telling the citizen what the federal agencies are doing is at the heart of the U.S. approach. Whenever it asks the individual to supply personal information, each agency must tell that person what legal authority authorizes the solicitation, whether supplying it is required or voluntary, the purposes for which the information will be used, and the routine uses to be made of ite. Once each year, at least, each agency must publish a notice about each system of records it maintains. This must indicate the system's name, location, and categories of persons covered; the routine uses made and the users; the agency's policies as to storage, retrieval, access controls, and retention or disposal of the data; and the procedures by which an individual can be notified if there is a record about him or her, and how access is provided to see and contest a record. Under the U.S. law, individuals who believe their privacy has been violated are given the right to bring a lawsuit in federal court; no registration board or official ombudsman is provided. About a fifth of the American state governments have passed similar laws for state agencies.

3.3.4 Differences in Regulation Mirror Differences in National Political Cultures

There are obviously important variations in these three main approaches to controlling the misuse of databanks and record-systems. The differences mirror the Swedish-German confidence in powerful administrative agencies, state registration, and detailed codes of procedure. The British (under both Labor and Conservative Governments) have looked to government officials and private managers to observe codes of proper behavior, and have, thus far, been ready to intervene with legal enactments and criminal penalties only if this self-regulation proves inadequate. (As of 1983, some legislation may be enacted in Britain to meet minimum requirements of the Council of Europe Convention on national data protection standards for member countries.) In the United States, the concept of "fair information practices" for federal agencies was developed out of long-standing American legal concepts that forbade "unfair labor practices," or "unfair trade practices," and rely upon public notices, citizen complaints, and supervision by the judiciary through privately-initiated lawsuits. Efforts by privacy advocates to create an independent national commission or agency to monitor data protection or receive citizen complaints have not received majority public support in the U.S., partly because of anti-bureaucratic sentiment and partly because of the belief that courts enforcing citizen rights provide the right remedy for correcting abuses.

In summary, most of the major Western democracies have addressed the issues of computers and privacy during the past two decades. While the legal and administrative mechanisms vary among political systems, a set of basic principles have evolved as to relevance and propriety standards for data collection; notice and access rights to data subjects; and confidentiality and security rules for data handling. These principles are now operating as law or strong social norms in most of the industrial democracies.

4. NEW PRIVACY ISSUES IN THE 1980s

4.1 The Political Context of Privacy Developments Since the 1960s

As we have shown, the first 25 years of computer use generated early alarms in the late 1960s and early 70s over possible misuse of new information power by public and private organizations; followed by the evolution in the 1970s of modernized "privacy principles" to fit the new processes of automated data handling; and then leading to the creation of diverse administrative and legal structures in most Western democracies to apply the new privacy standards. Though it would take a great deal more space than is available here to document my judgment in detail, the conclusion that I draw from these two and a half decades is that this response has been, overall, a successful adaptation of civil liberty traditions to sweeping technological change, measured in terms of prevailing social and political opinions in Western parliamentary systems.

This point needs at least a little explanation. In countries with new privacy or data protection laws, the dialectic of adoption has been one in which civil liberties groups (with legal and professional allies, the media, etc.) protested serious potential invasions of privacy (with some examples of actual abuse in automated systems to refer to and much evidence of past abuse in the traditional manual record systems that were in the process of being automated). Given the equally potential possibility of a revolt of the data-subject masses that might be sparked by this protest -- by consumers, employees, patients, taxpayers, etc. -- leaders in the public and private sector had to consider whether new rules and even laws might be necessary to insure cooperation of data subjects.

At this point, the political struggle in many nations became one involving three basic positions: those wanting to use the "privacy protection" issue to spur major changes in the institutional balances and power relationships of their societies; those seeking only cosmetic or minimal rules involving use of personal information to make judgments about individuals; and the position that has generally prevailed -- an expansion of individual privacy and due-process rights in new automated information systems. That expansion received major assistance because it was linked with the larger social movement in the West during the same two decades that won new equality rights for minorities and women, freedom of individual sexual choice and cultural lifestyle, and other increased personal rights against enforced organizational control, by government or private forces.

What has not happened -- to the regret of some observers -- is that the "privacy issue" has not proved to be a magic button with which either left-oriented social reformers or their libertarian-right counterparts could compel their societies to dismantle the large-scale state (whether capitalist or socialist), or block integration of various private consumer-service developments spurred on by new technological capabilities, or alter the delicate balance between law-and-order policies and confrontational social protest that majorities in most Western democracies came to see as essential for the preservation of ordered society in the 1970s and 80s. In short, the privacy policies adopted, with some variations, by most of the Western democracies over the past 25 years have been essentially liberal extensions of individual-rights concepts to new high-technology developments.

In my judgment, institutionalizing rights of privacy and due process vis a vis large organizations has increased the visibility and accountability of organizational decisions. In so doing, privacy rules have allowed the public to learn more about the substantive policies being carried out by private and public organizations, and to frame for public judgment whether those policies do or do not fit the values and wishes of the citizenry in each country. In that sense, privacy has been to political life what it has been in individual life -- not an "end state" but an "instrumental" value.

4.2 Development and Use of New Technologies in the 80s

The 1980s are a decade in which several basic attributes of information technology that began to be adopted by organizations in the 1970s will increase substantially in power and scope of use. We see that data input and data storage are becoming vastly cheaper; microcomputers are proliferating by the millions in offices and homes; and advances in data communication are making networking and interactive services far more cost effective.

These powerful new capacities of information technology are linked to a worldwide economic situation in the mid-80s in which the production of cheaper goods and services and the reduction of the costs of government operations are top priorities for organizational leaders. The result is major experimentation in both the private and public sectors to see whether new high-technology approaches, though they require large capital investments, may achieve substantial savings in labor, distribution, and servicing costs that would add up to significant reductions. This has become a driving force in the approach to information technology uses in the 80s; "need" rather than "choice" is the mood of many organizational managers, and it provides powerful incentives for action.

(What this trend may do to overall employment levels in Western societies that pursue such high-technology paths is not at all clear yet. However, to the extent that large segments of the public come to see microelectronics as a threat both to current jobs and to careers, they are likely to invoke "privacy issues" in the applications of microelectronics as a weapon with which to oppose heavy conversions to automation in factories and office.)

Looking at new technological applications under way in the 1980s, there are five areas that seem to me to pose important privacy issues for consideration:

* At the workplace, heavy automation of office and customer-service functions, with the possibility of increased supervisory monitoring of terminal operators, as well as increasing EDP-based monitoring of health conditions of workers to identify and respond to occupational health problems.

* In the home, the growth of interactive consumer information systems, whether through wired cable television or computer/telephone links, through which householders will engage in banking and shopping, obtain house security, purchase education and entertainment, and even contribute their opinions to various polls and surveys.

* In the community, development of "smart card" systems for consumer use and for citizen-identification purposes.

* In public places, a growing resort to camera surveillance systems for protection against crime with EDP links.

* In government operations, the conversion of large third and fourth generation computerized databases into new, more integrated databases, especially in fields such as law enforcement, taxation, welfare and health services, etc.

Much could be written describing why and how each of these new uses of information technology are unfolding. However, while Western nations will differ in the extent to which these new applications are being actively pursued, I believe substantial activity in many of these five areas will take place in the next decade in most Western nations.

4.3 The Privacy Implications of These Trends

The first question is whether the kinds of technological applications just described, with the clear potential for privacy intrusion that they pose, represent developments that will be handled adequately with the privacy-protection laws and administrative machinery already in place or whether new measures will need to be adopted.

My judgment is that:

* No new principles as to privacy and due process need to be enunciated to deal with the new applications.

* However, new campaigns of public education will probably be needed to explain the potential threats to privacy that such new applications clearly present, to generate the necessary political support for citizen protection.

* If that educative process takes place -- and those countries with standing privacy boards and commissions in place may be in a better position to foster such public education than countries lacking such centers of competence and public mandate -- then the task will be to apply the privacy-protection standards for automated systems to these new settings.

* In the European data-protection-board nations, home information networks or video terminal monitoring at work could be handled without new legislation or new administrative structures by the existing machinery. In countries such as Britain and the United States, however, it will probably take new legislation and possibly the creation of new administrative machinery to assure basic privacy and due process rights in the areas I have cited. Though some experts might argue that organizational managers of these new EDP systems will install privacy rules voluntarily in the U.S. and Britain, my sense is that -- while some organizational leaders will do so, and thereby help to clarify real-world choices and their effects -- it will take minimum-rule legislation at some point in the 80s if the new EDP systems are to be fitted into the overall value balances as to privacy, disclosure, and surveillance that were set in the first two decades of EDP use.

5. CONCLUSIONS

Following the historical and political analyses presented in this paper, I conclude that:

* Development of new privacy protections for increasingly automated societies in the West has proceeded fairly well during the first 25 years of EDP impact -- if one realizes that this has been the result not of noblesse oblige by organizational managers but of determined political campaigns by various privacy advocates and a strong concern over privacy by the general publics of democratic nations.

* While the legal definitions and administrative systems predictably vary by national political cultures, a basic core of privacy rules and safeguards has evolved in Western democracies, and has

been put into place by a majority of these countries.

- There are some powerful new applications of information technology being actively pursued by private and public forces in the 80s that pose important new issues of privacy. It will require a combination of public education and public demand for existing privacy rules to be extended to cover these new areas. This will not happen automatically. Therefore, an active role will be called for by all those who believe that social interests in efficiency and liberty can be reconciled through intelligent public policies.

- As to _what_ rules will be required for privacy protection in new applications, much will depend on the institutional forms and new operating organizations that arise to manage these new EDP systems. Here is where EDP professionals, and the new generation of EDP-literate organizational leaders -- because they understand how system-choices can affect privacy risks and safeguards -- have a major role to play in the next decade.

REFERENCES

(1) Material in section 2 is drawn from two of this author's works, _Privacy and Freedom_, Atheneum, New York, 1967 and "Privacy," in the 1972 Yearbook, _World Book Encyclopedia_.

C. CHARTER OF PRIVACY REVIEW BOARD AND POLICY GUIDE FOR AUTOMATED PERSONNEL INFORMATION SYSTEMS, High-technology manufacturing compan

PRIVACY REVIEW COMMITTEE

PURPOSE

The purpose of the Privacy Review Committee is to maintain consistency in the observance of corporate data privacy policies and procedures. Further, it is to assure the corporation's compliance with the various state privacy laws and the applicable recommendations of the Federal Privacy Protection Study Commission.

SCOPE:

The scope of this committee encompasses the data privacy issues relating to domestic recordkeeping practices of the corporation.

MEMBERSHIP:

Committee membership shall consist of current or former representation from:

- Corporate Legal Department
- Line Personnel
- Staff Personnel
- Chairperson of the Employee Relations Committee
- Personnel Systems & Records Administration

The chairperson shall be appointed by the Vice President of Personnel and Administration.

This committee will report to the Vice President of Personnel and Administration.

RESPONSIBILITIES:

- Advise in data privacy policy interpretations.
- Recommend policy and/or procedure modifications.
- Approve the relevancy of information destined for data collection in employment recordkeeping files or systems.
- Periodically review a sample content of recordkeeping files or systems with the purpose of eliminating items of information which are no longer relevant.
- Approve communications on data privacy.
- Assist in providing the data privacy subject matter for inclusion in personnel office audits or reviews.
- Maintain an active communication link with the Employee Relations Committee and other committees where data privacy is a point of interest; eg., Security Committee .

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APPROVED POLICY AND PROCEDURE
ON
AUTOMATED PERSONNEL DATA SYSTEMS

PURPOSE

It is the purpose of this policy to provide guidelines for the installation and utilization of Automated Personnel Data Bases.

POLICY

All personnel data bases whether automated or clerical, will contain standardized code schemes for basic elements to ensure that aggregate reporting to upper management can occur effectively. Compliance with internal business systems standards on hardware and software usage is required.

Operations within the United States with the exception of those acquisitions, partnerships and joint ventures which by negotiated agreement are excluded, will utilize the Corporate Computerized Personnel System.

To control and protect the data privacy of all employee information, requests for "hand-off" files (magnetic tapes, punched cards, data transmissions of extracts, etc.) must be approved by the requestors' senior personnel executive and a statement describing their intended use of the data must be provided to Personnel Systems Planning and Administration for review with the Corporate Privacy Committee.

Subsets of the corporate employee data base which are downloaded to local operations' micro computers will be provided only for specific uses and are not to be used to independently update employee data fields. Use is restricted to local informational and corporate dictated requirements.

Redundant data bases which serve no unique purposes should be eliminated. Such redundancies are contrary to the intent of corporate policies on data privacy.

Operations outside the United States must utilize standardized code schemes as well as one Automated Personnel System per country to serve all organizations within that country. Request for more than one Automated Personnel System per country must be approved by the Vice President, International Personnel.

Country management is responsible for the operation of personnel data bases and will design the features to meet their local management and government reporting needs.

SCOPE

This policy is to be implemented worldwide.

DEFINITIONS

1. U.S. Operations

All U.S. operations will utilize the Corporate Computerized Personnel System. Since there is a dependently active interface between the Automated Personnel System and Payroll System, any exception to this must be approved in writing by the cognizant company president.

2. Non-U.S. Operations

Feasibility justification and cost estimates for the development and installation of Automated Personnel Systems must have the approval of the Vice President, International Personnel.

To reduce development expenses, countries must use computerized personnel programs from existing operational systems whenever practical.

The major function of such systems is to provide automated reports for personnel and management at the country level so they can more effectively and economically manage their personnel reports to Corporate management.

PROCEDURE

Individual countries will provide their own personnel data base element need which are exclusive to their local management and governmental requirements.

The computerized Personnel Master File must have an active interface with the country's payroll system to ensure that payroll/personnel data are accurate and current.

Standardization of code schemes governing the content of certain basic elements must occur across all country Personnel Data Bases throughout the Corporation. Lists of these standardized elements are obtained from Corporate Personnel Systems in

The existing Corporate Employee Records Manual contains the affected data element code schemes.

Input documents must contain standardized formats to reflect standard data elements in all countries plus the flexibility to accommodate local data needs. This standardization will provide ease in document interpretation when transferring personnel and their records from one country to another.

Ultimate exchange and aggregating of data from the various country Personnel Data Bases will be defined in specific local procedures as new personnel systems become operational. Corporate Personnel Systems Planning and Administration has the responsibility to coordinate such interfaces which deal with total corporate reporting.

Corporate Personnel Systems Planning and Administration will provide assistance and guidance in the development of automated personnel data bases in non-U.S. countries.

1. Data Privacy

   A. U. S. Operations

      Corporate Personnel Systems is responsible for the development and implementation of department procedures which comply with the Corporate policies on data privacy. This includes the interface procedures with the data processing center to insure protection of individually identifiable information in the movement in and out of computerized systems. Other requirements include:

      (1) Providing annual print-outs (microfiche) of computerized data bases housing individually identifiable information. The output records are subject to employee review for accuracy of data.

      (2) Initiate the erasure of individually identifiable information from computer storage media immediately or at the most reasonable time after usage (example: print tapes with sensitive employee data).

      (3) Utilization of all security features within the computer operating system (passwords, changing of passwords, log-in protocol, etc.).

(4) Perform periodic reviews of automated systems file content to surface obsolete and/or irrelevant data.

Any   function receiving an authorized automated "hand-off" file from the Corporate Computerized Personnel System must initiate procedures which protect against the improper use of individually identifiable information. These procedures must conform to the corporate policies on data privacy.

B. Non-U.S. Operations

For Non-U.S. operations, the respective country Personnel function is responsible for the development and implementation of data privacy policies according to legal constraints and employee relations requirements existing within the individual countries. The local country data processing function must assist in the formulation and implementation of data privacy procedures relating to automated personnel systems.

C. Micro Computer Use

The use of micro computers in processing employee information shall be in accordance with the   policy on Protection and Disclosure of Personnel Information, Policy 6:12:03, paragraph A (2) and E.

INTERPRETATION

Personnel Systems Planning and Administration

RESPONSIBILITY

Deputy Chairman

CROSS REFERENCES

6:11:01	Legal Service of Process and Contracts with Outside Authoritie
6:12:03	Protection and Disclosure of Personnel Information
6:12:06	Protection of Data Privacy in Employment Records
6:12:07	Data Collection of Employee Information
6:12:08	Employee Access to Personnel Records
6:12:10	Data Privacy for Medical and Exposure Information

Personnel Manager's Manual

PM:15:02 Employee Personnel File System

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D. GENERAL SERVICES ADMINISTRATION
Washington, D.C. 20405

DRAFT: 11/1/84

FIRMR BULLETIN
FEDERAL INFORMATION RESOURCES MANAGEMENT

TO: Heads of Federal agencies

SUBJECT: Microcomputer security

1. Purpose. This bulletin highlights the importance of agencies providing necessary security for their microcomputer systems. It is designed to reinforce the need for proper management of microcomputer systems, as cited in FIRMR 201—7.102. In addition this bulletin provides very general guidance materials to assist in enhancing microcomputer security procedures.

2. Expiration date. This bulletin remains in effect until superseded or canceled.

3. Background.

a. Numerous studies and reports have been published by Congressional committees, consultants, GAO, and others on the computer security problems in the Federal Government. The Congressional Research Service report, "Computer Security: An Overview of National Concerns and Challenges" (no. 83—135 SPR of February 3, 1983), states that the Federal Government is paying insufficient attention to the growing problems of computer crime, privacy and unauthorized access of data bases. The Federal Managers' Financial Integrity Act of 1982 requires Federal managers to establish a continuous process for evaluating, improving, and reporting on internal control and accounting systems that have been established to avoid waste, fraud and abuse.

b. Many automatic data processing (ADP) facilities have performed risk analyses in accordance with FIRMR 201—7.103—2 that resulted in the implementation of security procedures for mainframes and minicomputers, but not for microcomputers (micros). Many magazine and newspaper articles have referenced the growing problem of micro abuse or misuse. Varying reports have shown that over half of the computer fraud perpetrators and abusers are users and data processing personnel.

c. The "Counterfeit Access Device and Computer Fraud and Abuse Act of 1984" (signed into public law on October 12, 1984) created misdemeanor and/or felony penalties for abuse, unauthorized access, and misuse of Government—owned or operated computers.

4. General.

a. Many micro users are not aware that abuse, unauthorized access, and misuse of government—owned or operated computers could result in prosecution. This situation usually is a result of insufficient guidance concerning the importance of securing equipment, systems, and data processing information. Proper training, policies, and procedures are critical factors in safeguarding microcomputer systems.

b. It is imperative that Government agencies review and reassess current security measures that are applicable to micros. Higher—level officials need to clearly delegate responsibilities for achieving specific security goals for micros.

5. Security measures for micros. The major goals of security management are: detection, correction, deterrence, prevention, avoidance, and backup. Suggested methods for obtaining these goals are:

a. Detection:

(1) Microcomputer security officers should be assigned to monitor ongoing micro system security and report security problems to the appropriate manager(s) and/or higher—level official(s).
(2) Information on breaches in security of other micro systems should be used as a warning that similar breaches could occur on your system.
(3) Periodic testing and analysis of ongoing security procedures should be used to detect possible loopholes in security.
(4) Micro users should be questioned periodically for ideas to improve security, since some studies show that over half of the recent security breaches were detected and reported by users.

b. Correction:

(1) Immediate steps should be taken to correct any problems that have been detected or suspected.
(2) Internal policy should be reviewed and revised as necessary to ensure that effective security measures are being implemented.

c. Deterrence:

(1) Warnings should be posted to make current and potential users who attempt to access a system aware that they are subject to prosecution for abuse or unauthorized use of Government—owned or operated micros. An example is: "Unauthorized access or misuse of Federally owned or operated computers is punishable by Federal law."

(2) Both new and departing users of micro systems, should be required to sign a statement that they will not abuse, misuse, or promote unauthorized access to the micro equipment and its data files.

(3) Scramblers and encryption devices should be used to avoid easy access via telecommunication media.

d. Prevention:

(1) Security devices should be installed to prevent theft of equipment.

(2) Locks over the "On and Off" switch should used to prevent easy access if the micro is in a location that is easily accessible by unauthorized persons.

(3) Passwords that consist of six or more characters should be used to make unauthorized access more difficult. However, there are many cases of passwords being deciphered or accessed by unauthorized persons.

(4) Managers should have security checks performed on the background of those employees who will be working with or around micro systems that are used to process sensitive data.

e. Avoidance:

(1) Micro users should exercise common sense in securing their micros, floppy disks, peripherals, and user documentation. For example:

(a) Do not post passwords on or near the micros,
(b) Do not use family, friends, or easily decipherable names for passwords,
(c) Do not leave equipment or documents in an unlocked or easily accessible location, and
(d) Do not process sensitive data on a micro that is located in a non—secure area.

(2) The microcomputer security officer(s) should maintain a security log which references the micro equipment and the person who is primarily responsible for that equipment.

(3) Internal controls should be established and maintained to check the distribution and usage of floppy disks and other micro equipment.

(4) Caution should be exercised when placing additional software and peripherals to micros, since micros are more prone towards short—circuiting due to electrical overloading.

f. Backup:

(1) Floppy disks that contain pertinent data should be duplicated and the duplicate should be stored in a secure, conducive, and reasonably remote environment.

(2) Identical micro systems should be located and used as a backup facility if possible (Note.——Compatibility with these sytems must be tested and maintained in order to use them on an as needed bases).

6. Information and assistance.

a. Most security guidance materials emphasize mainframes rather than micros. Properly trained personnel can easily extract information that is applicable to micro security. A number of documents providing valuable guidance on security considerations are listed in "Computer Security Publication", NBS Publications List 91. This list is available from:

Standards Processing Coordinator (ADP)
Institute for Computer Sciences and Technology
Technology Building, B—64
National Bureau of Standards
Gaithersburg, Maryland 20899
Telephone: FTS or (301) 921—3414.

b. Good training in microcomputer security is a key to maintaining secure systems. Many training programs and guidance material are available to promote security for ADPE. We suggest that agency managers seek training programs on micro security to ensure that their employees are and will be applying proper security measures .

7. Distribution of this directive. Because the FIRMR looseleaf edition distribution list has not yet been established, this FIRMR bulletin will be distributed to addressees on GSA's FPR and FPMR Subchapters B and F publication distribution lists. It is suggested that the directive be retained for continuing use until the provisions are incorporated into the FIRMR or are otherwise superseded or canceled.

FRANK J. CARR
Assistant Administrator
Office of Information
Resources Management

106.

Computer Science and Technology

NBS Special Publication 500-120

Security of Personal Computer Systems: A Management Guide

Dennis D. Steinauer

Center for Programming Science and Technology
Institute for Computer Sciences and Technology
National Bureau of Standards
Gaithersburg, MD 20899

U.S. DEPARTMENT OF COMMERCE
Malcolm Baldrige, Secretary

National Bureau of Standards
Ernest Ambler, Director
Issued January 1985

ABSTRACT

The use of personal computer systems (often called desktop or professional computers) in the office and home environment has placed increasingly powerful information system technology in the hands of growing numbers of users. While providing many benefits, the use of such small computer systems may introduce serious potential information security risks.

Although considerable progress has been made in security management and technology for large-scale centralized data processing systems, relatively little attention has been given to the protection of small systems. As a result, significant exposures may exist which can threaten the confidentiality, integrity, or availability of information resources associated with such systems. To ensure effective protection of these valuable resources, managers, system designers, and users must be aware of the vulnerabilities which exist and control measures which should be applied.

This report describes management and technical security considerations associated with the use of personal computer systems. The primary objective is to identify and discuss several areas of potential vulnerability and associated protective measures. The issues discussed include:

- Physical and environmental protection
- System and data access control
- Integrity of software and data
- Backup and contingency planning
- Auditability
- Communications protection

In addition, a general plan of action for the management of personal computer information security is presented. References to additional information, a self-audit checklist, and a guide to security products for personal computers are provided as appendices.

In general, the term "personal computer" refers to single-user systems. However, most of the discussion in this report applies equally to other types of microprocessor-based systems designed for use in a general office environment (e.g. word processors, workstations, and various types of office and home computer systems).

KEYWORDS: computer security, small computers, office automation, access control, cryptography, personal computers, microcomputers, backup, contingency planning, auditability

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F. United States Department of Agriculture Guide Line

U.S. DEPARTMENT OF AGRICULTURE
WASHINGTON, D.C. 20250

DEPARTMENTAL REGULATION

NUMBER: 3140-1

SUBJECT: USDA ADP Security Policy

DATE: July 19, 1984

OPI: Agency Technical Services Division
Office of Information Resources Management

1 PURPOSE

This regulation establishes policies and responsibilities for safeguarding the Department's ADP resources and protecting the privacy of automated personal data.

2 CANCELLATIONS

This regulation replaces:

a Agriculture Property Management Regulations, Subpart 104-32.50

b Title 11 of the Administrative Regulations, Chapter 4, Section 6, Security and Privacy

c Departmental Information Processing Standards, Chapter 6, ADP Security and Privacy

3 POLICY

USDA shall establish and maintain a comprehensive security program to assure adequate protection of ADP resources. The program shall incorporate all applicable laws and Federal and Departmental regulations.

It is essential to assess the sensitivity of data and the sensitivity and criticality of processing; to establish data ownership; and to develop rules for access to programs and data.

Security should be a major determinant in evaluating use of microcomputers or personal computers, particularly in a network environment. Microcomputer systems software is typically rudimentary and affords essentially no protection to data and programs. Establishing ownership of shared data bases in a microcomputer network and maintaining adequate access control, update procedures, and backup present complex problems. Therefore, it is USDA policy that when microcomputers are used to process sensitive information, controls, both technological and procedural, must be used. If adequate security cannot be maintained in this environment, other system configurations should be used.

DISTRIBUTION: 31

4 BACKGROUND

Use of advancing technology and ever-growing dependence on electronic information processing render the Department increasingly vulnerable to abuse and misuse of information resources. The USDA ADP security program is designed to protect the confidentiality and integrity of information; to assure the availability of ADP and WP services, and to afford adequate physical protection to all information resources.

The expanding use of personal computers, distributed data bases, and telecommunications places additional responsibilities on office managers, research personnel, and others not previously considered information processing professionals. No longer can we rely on "the computer center" to protect our operations. Controls must be placed and administered where they are most effective. Local procedures must be developed, documented, implemented, and monitored to assure reasonable and effective management of both traditional and new technology.

5 DEFINITIONS

a ADP Resources. ADP, office automation, and telecommunications equipment, facilities, supplies, services, and software; personal computers; and programs and data.

b Sensitive Information. Sensitive information is information whose loss, unauthorized modification, or unauthorized disclosure would be detrimental to agency operations. Examples: information that is personal, proprietary, financial, National Security-related, or critical to agency plans and operations.

6 ABBREVIATIONS

ADP	Automated Data Processing
OIRM	Office of Information Resources Management
WP	Word Processing

7 APPLICABILITY

This regulation applies to the management of all ADP resources of the Department of Agriculture. It applies to processing done on equipment that is:

Government-owned or leased, whether Government- or contractor-operated; or
Accessed through commercial timesharing acquired under a USDA contract.

To the extent practicable, this regulation shall also be applied to processing done on equipment that is:

Accessed through commercial timesharing acquired under GSA schedule contacts;
Operated by a cooperator in accordance with a specific cooperative agreement, or a grantee in accordance with a specific grant; or
Employee-owned, when used to process USDA information.

Processing of USDA information on employee-owned equipment must be authorized by the appropriate agency management.

This regulation applies to the security of all automated information that is collected, transmitted, used, processed, stored, or disposed of by or under the direction of USDA or its designated agent.

8 STANDARDS AND PROCEDURES

Standards, procedures and guidelines for the protection of ADP resources are contained in DM 3140-1, ADP Security Manual.

9 RESPONSIBILITIES

a The Director, OIRM, is responsible for:

(1) Developing and issuing ADP security policy and regulations.

(2) Reviewing and approving agency ADP security plans.

(3) Assisting agencies in ADP security program development and administration.

b Each Agency Head is responsible for:

(1) Determining the agency's mission requirements for ADP security and for furnishing adequate protection to personal data, as defined in the Privacy Act of 1974 (PL 93-579, 5 U.S.C. 552a), and other sensitive information.

(2) Establishing an agency-wide program for ADP security, consistent with the agency's mission, including designating a responsible individual to serve as the agency ADP Security Officer.

(3) Budgeting for ADP security and committing adequate resources to assure compliance with all Federal and Departmental ADP security requirements.

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(4) Developing and updating agency and facility ADP security and contingency plans.

(5) Assuring that all sensitive ADP applications are certified.

(6) Assuring that all procurements of ADP equipment, software, and services incorporate adequate security provisions.

(7) Assuring that Departmental security regulations are properly disseminated and that all requirements of DM 3140-1 are met.

(8) Authorizing the use of employee-owned equipment for the processing of USDA information.

c ADP Facility Managers are responsible for:

(1) Designating an individual as the ADP Security Officer for the facility when the facility meets the criteria specified in DM 3140-1.

(2) Maintaining the security required by missions of the agencies whose data is maintained or work is processed at the facility.

(3) Developing and updating ADP security and contingency plans.

(4) Backing up user programs and data, as specified by the user.

d ADP Security Officers are responsible for:

The development, administration, and oversight of agency ADP security programs. Whenever possible, the ADP Security Office should have security as the primary area of responsibility. Deputy Security Officers and security representatives should be designated to assist the primary Security Officer in assuring that all sites which use, process, or store data afford adequate protection to resources. Security Officer responsibilities are detailed in DM 3140-1.

-END-

G. UNITED STATES DEPARTMENT OF AGRICULTURE "Risk Analysis Procedures"

ADP SECURITY MANUAL

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APPENDIX A

RISK ANALYSIS PROCEDURES

1 BACKGROUND

USDA regulations require inclusion of a risk analysis summary as part of the annual ADP security plan all user agencies, all major ADP facilities and some smaller facilities must prepare or update annually. Federal regulations require inclusion of a current risk analysis summary in all RFPs for facilities, equipment or services, when processing of systems of records covered by the Privacy Act is involved.

USDA regulations also require the development of contingency plans; these call for maintenance of off-site storage of tapes, disks, documentation, and other items required to transfer critical processing to an alternate site when the ADP facility is rendered inoperable. For contingency plans to be viable, this off-site material must be current and complete. A facility risk analysis, which evaluates the completeness and condition of present backup, is prerequisite to contingency plan development.

Risk analysis is an assessment of the vulnerability of a specific facility or organization and deals with a unique set of assets and conditions. "Assets", in the broad sense, includes data, software, equipment, buildings and furnishings, and the availability of the ADP facility's services. Physical surroundings, vulnerability to natural threats or subversion, effectiveness of protective measures in use, sensitivity of data processed, etc., must be considered.

For a risk analysis to fulfill its purpose, it must represent a considered judgment of threats to assets at a particular place at a specific time, with known and documented existing conditions. For example, a risk analysis study performed on an ADP facility when there was no off-site storage maintained and minimal processing took place would have little relevance after the facility has acquired off-site storage facilities and increased its work load.

There are many definitions of risk analysis, and a number of procedures for performing the analysis have been developed. The method detailed here is simplified but adequate. Much of the process requires use of subjective decisions and, sometimes, pure guesses. Experience shows, however, that if carefully done this process produces valid results.

In essence, a risk analysis is the development of answers to the following questions:

a How good is security now?

b How good does it need to be?

c What are the threats to assets in the ADP environment?

d What is the likelihood each of these threats will be realized?

e What would be the annual loss expectancy (ALE) if each threat is realized?

f What measures can be taken to minimize the chances of threat realization?

g What would each countermeasure cost (annualized amount)?

h What is the anticipated ALE reduction of each specific threat for each countermeasure considered?

i What is the resultant cost/benefit value (in dollars) associated with each countermeasure? (Aggregation of all ALE reductions expected to result from use of the countermeasure vs. its annualized cost.)

2 SECURITY THREATS

Security threats can be of many types and of varying degrees of severity. They can produce a broad range of untoward results, if realized. For example, one real and constant threat is fire. But how does one define fire? It can be a holocaust that wipes out the facility and all service areas, a fire in the CPU, a smoldering chemical fire which produces corrosive materials, etc. Depending on the extent and type of damage and the time required for recovery, the facility could be down for hours - or weeks - or months.

We have neither the time nor resources to attempt to assess all threats nor to consider all permutations any one threat might pose. Rather, in the interest of simplifying the task and cutting it down to a size we can cope with, we have arbitrarily defined two types of threats, major and minor, with the full knowledge that some "in between" threats will be excluded from consideration. Still, a risk analysis based upon only these two types of threats will produce a useful product.

They are defined:

a Major Threat. An event which threatens all the facility's assets. It can be an event of catastrophic proportions which destroys the ADP facility or renders it inoperable. Examples: fire, flood, earthquake, tornado, bombing, riot. Assumption is made that all attendant areas of the facility, such as the tape/disk library, are destroyed. Relocation to an alternate processing site is required. Only the material stored off-site is available for use. Or a major threat can be a plumbing leak which damages assets and delays processing, but does not destroy the facility.

b Minor Threat. This category includes all the deliberate or accidental failures, errors, and mishaps encountered daily. While each occurrence may result in relatively short processsing delay or minor distortion or loss of data, the cumulative cost of many occurrences can be significant. Examples: CPU failure, wrong tape or pack mounted, listings lost, air conditioning failure.

It is necessary to define and evaluate threats according to the kind of adverse effects the threats pose. For example, the statement that fire potentially will cause a loss of $10,000 is incomplete. It is much more meaningful to state that fire will result in $5,000 loss from data destruction; $3,000 loss from delay in processing; and $2,000 loss from damage to ADP equipment. To devise countermeasures to threats, thereby improving security (the purpose of the risk analysis), not only must we identify specific threats; we must also define the nature and scope of the potential harm. Use of the four categories listed below facilitates meaningful identification of the types of exposure each specific threat poses.

Security Exposure	Possible Results of Security Failure
Data Integrity	Destruction or unauthorized modification of data, unintentional or deliberate.
Data Confidentiality	Unauthorized disclosure of sensitive data.
Operational Reliability	Processing that is undependable, inadequate, delayed, or unavailable. (Processing should be accurate, dependable, and timely.)
Asset Integrity	Destruction or physical damage to buildings and equipment and supporting functions.

In general, the first three categories represent threats to data and processing. Asset integrity can most often be related to physical assets: equipment, supplies, furniture, storage media, etc.

The following list of threats is suggested for consideration. It is not intended to be all-inclusive. Conversely, many of the threats listed will be of little or no concern in specific situations.

External threats	Fire, flood, tornado, hurricane, earthquake, riot, bombing, water leakage on equipment
Environmental threats	Power or air-conditioning failure
Hardware error	CPU failure, memory fault, lock-out
	Peripheral device failure: disk, tape, etc.
	Device data transmission failure or error
Software error	Operating system, sort, compiler, DBMS, etc.
Operations error	Mounting wrong version of system software, mounting wrong user data: disk, tape
	Accident during change of system software
	Accident during application program test or implementation
	Accidental destruction or modification of data by operations personnel
	Accidental disclosure of sensitive data
	Loss or misplacement of listings

	Misrouting of messages
	Misplacement of user data or program files
Subversive actions	Theft, arson, sabotage, "slow down" tactics
	Unauthorized data, program, or systems software modification
	Unauthorized access to sensitive data

3 COSTS

It is necessary to establish ground rules before attempting to develop costs expected to be incurred because of security inadequacies. For instance, whether the facility is operating on a profit or non-profit basis has direct bearing on costing. Decisions must be made on how to handle personnel salaries, rental vs. owned equipment, etc. These determinations must be made on an individual basis for each facility and its users and the details included in the risk analysis report.

When assigning costs to the various threats, it is necessary to consider carefully all peripheral expenses. Transportation of personnel and material, per diem costs, purchase of equipment, contractor support, replacement of storage media and paper stock: all are valid considerations.

For users, most of the costs will be associated with reconstructing data and rerunning jobs and with penalties or delays caused by loss, modification, or compromise of data. Loss of processing time also might result in monetary loss. And cost of moving personnel and materials to an alternate processing site must be included in assessing costs of recovery from a disaster.

The team or individual developing costs for facility assets must include costs to restore all equipment, buildings, etc., to operational condition, as well as costs associated with recovery of systems software and facility data. It is a large order.

4 USDA RISK ANALYSIS CONCEPT

To measure risks effectively, it is necessary to evaluate all functions which interact through common services, extending beyond organizational lines. Thus, all users of an ADP facility participate in the analysis of that facility. The risk analysis should be under the direction of the facility manager.

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Procedures outlined here are intended primarily for use in assessing risk to a large Departmental Computer Center or other major ADP installation. However, with suitable modification the same method can be applied to risk analyses on smaller installations or agency ADP operations.

Essentially, the risk analysis consists of two parts, user tasks and facility tasks.

User Tasks:

a Identify sensitive and critical files and processes and give instructions for their protection.

b Develop total user costs to recover from realization of a major threat. (Threats are discussed in Section 2.)

c Develop ALE's to user files and processes from minor threats.

Facility Tasks:

a Evaluate present security.

b Identify major and minor threats.

c Develop costs to replace facility assets (including facility data) and recover from each major threat occurrence.

d Develop costs incurred from minor threat occurrences.

e Estimate the annual occurrence rate of realization of each major threat.

f Derive ALE's both for major and minor threats, incorporating data developed by users.

g Develop lists of remedial measures with potential to reduce losses. Perform cost/benefit analysis on these countermeasures. Submit list to facility management for approval.

h Prepare report. Include list of recommended countermeasures and all exhibits. Format for the report is included in this document.

As is evident, the larger number of tasks must be done by facility personnel. It should not be inferred, however, that theirs is the more important job. It can be argued that the only reason for the existence of an ADP facility lies in its function of service to users. User contribution is vital to the success of the undertaking.

We recommend that personnel familiar with broad agency programs, as well as computer programs and data, be assigned the task of assessing sensitivity and criticality of user data. If the number and size of systems render this a sizeable task, a team approach might be considered. We also recommend that agency management review all analysis results for reasonableness and completeness. (Detailed instruction to users is found in Section 5.)

We further strongly recommend use of a team for the facility tasks. On the premise that those best-equipped to deal with specific issues should do so, we suggest assignment of experts to the various sub-tasks. For example, auditors and safety experts can contribute materially, if requested. Seek out and use the diverse talents that can contribute to a successful risk analysis.

Risk analysis documentation may be prepared in any format that is meaningful and easy to use. OIRM will provide suggested formats or assist in developing agency-specific formats, if requested.

5 USER TASKS

a Identify sensitive and critical files and processes.

(1) Identify to the ADP facility those files which are sensitive (as defined in Section 4, ADP Security Manual) or for which the user, for any reason, desires special handling, backup, or off-site storage. For example, a data file may be non-sensitive by any definition, but its cost of reconstruction may be prohibitive. In such a case, the user should carefully consider back-up and off-site storage needs.

(2) Critical files are those whose loss, unauthorized modification, or lack of availability would seriously affect the user's processing. Critical processes are those which, if unduly delayed or denied, would result in serious detriment to agency program operations. Critical files and processes should be considered sensitive.

(3) For each sensitive/critical file or system, give agency name; the ADP facility used for processing; the system and/or programs using sensitive files or the names of critical processes; and the current date.

Give common file or process name.

For file sensitivity indicate: "S" (Sensitive) or "N" (Non-sensitive).

For process criticality: Give requirements, such as time, accuracy, etc.

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Specify mode of file transmission: mail, telecommunications, messenger, etc.

If the minimum standard for ADP facility security is not adquate to protect files or processes, state what protection is required.

Users should know or obtain a statement of the minimum security level maintained by their host facility. For DCCs the minimum standard is:

Security Exposure Category	Protection
DATA CONFIDENTIALITY	Protection adequate for the Privacy Act of 1974, including such items as logon identification, file level password protection, personnel clearances, administrative and procedural practices, and physical security.
OPERATIONAL RELIABILITY	Processing capability available to users 95 percent of scheduled time.
ASSET INTEGRITY	Weekly backup dumps of operating system and permanent on-line disk packs and backup as required for paper supplies (forms, checks, etc.).

b Develop total user costs for major threat recovery.

(1) This step is of vital importance. User costs to recover from serious disruption or loss of computing capability are crucial to the risk analysis study. As stated in Section 2, identification of threat categories associated with costs to recover furnishes guidance in selection of additional facility safeguards.

(2) For each major system develop costs to reconstruct data, transfer operations to new site, etc., in the event of disaster, using a data risk analysis worksheet and identifying the threats as "major". It is not necessary to identify specific threats unless there are differing loss expectancies associated with specific threats. For example, cost to recover from a major fire likely would be the same as the cost to recover from a destructive wind-storm. Consider present off-site backup in making

these assessments. Do not include a cost in the Asset Integrity category; loss of physical items is included in the facility's risk analysis. The reason for this is that physical assets such as tapes, disks, etc., are usually in the custody of the ADP facility, and it is facility security we are evaluating.

c Estimate annual minor threat costs.

(1) Experience has shown that minor threat ALEs far exceed major threat ALEs. For this reason, users should carefully estimate the total costs each system could be expected to incur because "something went wrong at the center." Users need not identify the specific associated threats; often they don't know the cause of problems. Rather, they should attribute anticipated costs to operational reliability, data integrity, etc. (See Section 2).

(2) Develop ALEs associated with minor threats, considering costs to reconstruct data and re-run jobs. Give a total value, in each appropriate security exposure category. Use data risk analysis worksheets to record the ALEs; identify types of threats evaluated as "minor." Remember that the only losses to be considered are those which occur while data is in the custody of the facility or is being processed. Do not include costs for which the user is responsible. No loss expectancy in the Asset Integrity category is required. The best approach to this task is to use recent experience as a basis for projecting future losses.

d Review results.

(1) OIRM suggests that user management review the sensitivity assessment and data risk analysis results for reasonableness and completeness.

(2) Since performing a risk analysis entails a careful inspection of user files and processes, it seems an ideal time for users to go a step further and assess the quality, completeness, and currency of the backup material, including documentation, stored off-site. It is also a good time to weed out out-dated or unnecessary processing and files.

(3) Forward completed documentation to the risk analysis study leader. Retain all work papers.

6 FACILITY TEAM TASKS

a Organize team; develop action plan with milestones for significant events; assign specific duties.

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b Meet with user representatives, both management and technical personnel, if possible, and explain the risk analysis procedure, identifying and describing user tasks.

c Evaluate present facility security; flag areas of weak security. Give immediate attention to potentially-serious deficiencies.

d Identify threats, using results of the evaluation as focus of attention. Categorize threats "major" and "minor." (A list of threats for consideration is in Section 2.) Note: the team may want to consider more than one degree of severity of a single threat, i.e., a catastrophic fire, one that destroys 10% of assets, etc.

e Estimate rates of occurrence of realization of these major threats.

f For major threats: develop costs for all threats to facility assets, data, and capabilities. Assign costs to the four exposure categories.

Remember that these figures represent costs to the facility, not users. This is also true of the minor threat costs discussed below.

g For minor threats: Use operational records, equipment failure reports, history of recent security breaches and problems, and informed judgement to estimate an annual cost for each minor threat. As for major threat costs, distribute over the exposure categories.

h Develop ALEs for major threats, using facility- and user-generated costs and facility-generated occurrence rates. Enter values for "Cost per Occurrence" and facility ALEs for the four types of exposure on a risk analysis worksheet. Add user ALEs and total.

i Calculate facility minor threat ALEs and list on risk analysis worksheet. Apportion user ALEs among minor threats the facility team has identified. Add user values to the worksheet.

This process may be confusing. The intent is to assign a proper portion of the expected losses to both the facility and users to specific threats and threat categories. An example may illustrate.

The threat is operator error. The facility team has estimated that operator errors will cost the facility as follows:

DI 10,000, DC 1,000; OR 50,000; AI 5,000.

User A has furnished estimates that all minor threats combined will cost annually:

DI 100,000; DC 30,000; OR 500,000; AI 0.

The facility team has decided that 10% of user minor threat losses can be attributed to operator error. Applying this percentage to user data, user A's ALE for operator error is:

DI 10,000; DC 3,000; OR 50,000; AI 0.

So, if the facility had only one user, total operator error ALE would be the sum of facility and user losses:

DI 20,000; DC 4,000; OR 100,000; AI 5,000.

j Sum all values, for both major and minor threats, to obtain total ALEs in the four security categories. Sum all values for each threat. Add these values to obtain the one value representing loss expectancy from all threats, major and minor. Enter values on worksheet. Prepare risk analysis summary.

k At this point the risk analysis study is technically complete. Now the team must use the study results to determine where and how security can best be improved. The team should consider various combinations of countermeasures which protect areas of greatest potential loss. Many times one countermeasure will address several problems. For example, installing a guard could be expected to reduce vulnerability to unauthorized access, theft, arson, bombing, fire, and water damage, particularly in an unattended facility. Guards, however, are expensive. The team must weigh the anticipated savings against the costs of remedial measures, then recommend a list of those considered most cost-effective.

l List countermeasures with annualized costs. Develop relationships between these countermeasures and threats they are intended to counter. Give expected savings (reduction in potential loss) for each countermeasure.

m Review with facility management the risk analysis worksheets and summary and the cost/benefit analysis.

n After facility management has reviewed all work and selected those countermeasures which it recommends for implementation, prepare the Risk Analysis Summary Report, including Exhibits, in the suggested format.

o Submit the Report for facility management approval and action. Retain all work papers.

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H. Office of Personnel Management Letter

Office of Personnel Management
AM Letter 22-2

Administrative Manual System Letter

SUBJECT: Microcomputer Security

Washington, D. C. 20415
October 23, 1984

There are a growing number of microcomputers located throughout the OPM. They are a "hot" item today, as well as being reasonably transportable, and as such are very susceptible to theft. In addition, the data maintained on this equipment is subject to misuse or loss.

Organization heads are responsible for protecting the computers and data located in their offices. The following are some precautions, procedures, and other steps which can help you carry out this responsibility.

PHYSICAL SECURITY

Assign responsibility for the physical and data security of each microcomputer or group of microcomputers to a specific employee. This should be someone who works with the system or systems, and knows who is authorized to use the systems and the data stored on them.

Do a risk assessment before purchasing any special devices to physically protect microcomputer hardware and software. Extensive security measures may be appropriate in certain locations because of past history and public access. Other locations with good overall security and little public access may require little additional equipment to secure microcomputers or to protect software.

The steps needed to prevent the theft of microcomputer hardware are similar to those for the security of any office equipment. Lock the doors. Keep commercial software packages in locked cabinets.

There are a number of commercially available devices for physically securing microcomputers. These are of two basic types — those that lock the hardware in a cabinet or under a large hood, and those that physically secure the hardware to a large item such as a desk. These items are all effective in providing physical security. The cost and convenience in your particular installation should govern your choice.

There are some things to look for in security devices. Microcomputers are basically delicate instruments, and you should avoid devices that require drilling holes in the hardware. Devices that prevent access to the interior of the microcomputer are preferable, as the easily removable boards in a microcomputer are often worth well over $1,000. Avoid any device which interferes with the day-to-day use of the equipment. For example, securing a movable keyboard in a fixed location eliminates the advantage of being able to position the keyboard in the most convenient location for the particular user. In most locations it is not necessary to secure every item of hardware — physically anchoring the microcomputer itself and the monitor is usually adequate.

Prevention of unauthorized use of the equipment is another consideration. This problem is most easily handled by various key operated devices which are available to turn off the power to the equipment at the outlet or prevent the off-on switch from being activated.

Distribution: Associate Directors, Regional Directors, and Heads of Other Offices

AM Code: 22 - Security

DATA SECURITY

You can protect data on microcomputers from unauthorized access through a variety of means. The easiest, and one of the most effective, is to store the data on floppy disks which are locked up (after clearing the data from the machine memory). This is feasible on both floppy disk machines and those with a hard disk. More and more offices are using the hard disk to store the software, and floppy disks for data. This is particularly helpful on machines used by more than one person.

If the data is stored on a hard disk, commercial software programs are available which provide protection by requiring the entry of a password in order to gain access to individual files. This is particularly useful on machines used by more than one person, as each person can access only their own data files. If all authorized users are permitted to access any file on the disk, and the concern is with unauthorized users, the easier solution may be a device to prevent the machine from being turned on, in conjunction with procedures to assure that the machine is never unattended when it is turned on.

Microcomputers are also sometimes used to access data stored on mainframe computers. The microcomputers are being used as computer terminals, and the security procedures in effect for accessing OPM mainframe computers apply.

PROTECTION AGAINST ACCIDENTAL DATA LOSS

A very real concern on all microcomputers is protection against accidental data loss. Data stored on any magnetic media is subject to loss. Floppy disks can be damaged by bending and even by atmospheric pollution. Hard disks are also susceptible to damage. We have experienced a number of hard disk failures, with loss of all data on the disk in each case. In most of these cases, backups had been maintained on floppy disks and the operation was not seriously affected. However, in one case a $750 recovery procedure was necessary because backups had not been maintained (and the office had no access to the data for about three weeks).

Backup floppy disks should be maintained on a regular basis of all data stored on either floppy or hard disks. Software is now available to help in assuring that the backups are made on a regular basis.

Backup of a full 10 Mbyte hard disk can take up to 30 floppy disks. This becomes quite unwieldy and time-consuming, and it is very difficult to enforce backup policies in these circumstances. Backup hardware devices are available which permit backup of a full hard disk on some other media (tape, a removable hard disk, or a high density floppy disk) in a few minutes. These systems normally run about $1,625 and up, depending upon the features desired, and are very helpful for maintaining backups of large data files. Most of these devices can be moved from microcomputer to microcomputer, so that one backup device can be shared by a number of machines. This requires a backup device driver board, running around $125 each, in each microcomputer.

Advice on microcomputer security and backup devices can be obtained from the Information Systems Plans and Policies Branch, Information Management Division, at (FTS) 632-7714.

William M. Hunt, Associate Director
for Administration

Footnotes

1. [A list of appropriate citations will be inserted in the final draft.]

2. See "Oversight of the Privacy Act of 1974, "*Hearings before a Subcommittee on Government Operations*," House of Representatives, 98th Cong., 1st, Sess., June 7 and 8, 1983, and "Who Cares About Privacy: Oversight of the Privacy Act of 1974 by the Office of Management and Budget and by the Congress," Eighth Report by the Committee on Government Operations, Nov. 1, 1983, U.S. Gov't. Printing Office, Wash., 1983, House Rept. No. 98-455.

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Privacy Issues in the Monitoring of Employee Work on VDT's in the Office Environment: Practices, Interests, and Policy Choices

Alan Westin

Columbia University

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Alan F. Westin

President, Educational
Fund for Individual Rights
(a non-profit foundation)

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I. SCOPE AND COVERAGE OF THIS REPORT

This is the first of two reports for an OTA Contractor Study on Privacy And Security Issues In The Use Of Office Systems Technology. In this first *Draft Report*, we examine the ways in which employers are using office systems technology to collect data on the quantitative and qualitative performance of employees working at VDTs (video display terminals). We describe how such monitoring is being used to make evaluative decisions about employees working at VDTs; discuss the privacy issues that have been raised about such uses; and examine alternative organizational and public policies that have been proposed to govern such uses of OA technology.

We begin this report by describing our research sources (Part II), then laying out a conceptual framework for our analysis (Part III). We explain why we will focus this report primarily on four types of clerical workers using VDTs intensively in their jobs, and on the significance of the fact that 80-99% of these workers are women. As specified in our OTA work plan, we lay out in Part IV a "baseline" of employer policies and practices as to work standards and performance monitoring that existed before the 1980s, when OA began to spread significantly into office work. Taking 1945-1975 as our baseline period, we outline how monitoring was being conducted and the social, legal, and labor-relations treatment of these pre-OA monitoring practices.

In Part V, we discuss what we call "transition" developments between 1970 and 1980. This was a period marked by important changes in monitoring technologies, social attitudes, employee expectations, legal protections of privacy, organzational approaches to employee and labor relations, and other factors. These changes modified important elements in the American work environment and social attitudes relating to it, just when microelectronics technology began to enter office work.

In Part VI, we draw on our own sources and others to describe how "machine based" monitoring of VDT work is being conducted today, and the social climate of the mid-1980s in which these uses are unfolding. We provide available estimates of the extensiveness of such use, and present our best judgment of how widespread such monitoring is in late 1984. We go on to describe the goals and reported accomplishments of managements in adopting individual-employee monitoring; the hostile reactions of various critical groups; and the movement of this issue from specialized forums to mass-media treatment in 1983-84. We then describe more specifically the positions of leading U.S. labor unions on machine-monitoring of VDT work; their collective bargaining and grievance activities on this issue; and their efforts to obtain general legal and regulatory controls over VDT monitoring.

Drawing primarily on site visits to 110 organizations that we made (see Part II), supplemented by interviews others have done, we present and analyze some reactions of VDT clerical employees to machine monitoring, in both non-union and union-represented organizations. We also draw on our site visits to identify three main types of management approaches to measuring individual VDT work performance, and to compare the approaches to monitoring that we found in the business, government, and non-profit sectors.

Turning to legal and regulatory developments, we describe provisions as to work monitoring that have been featured since 1981 in bills to regulate VDT use introduced and debated in state legislatures. We summarize the arguments for and against such legislative intervention that have been made by advocates and their supporting groups, reporting how these provisions have fared thus far and why.

In Part VII, we outline future technological capabilities that are likely to affect the nature and scope of machine monitoring of VDT workers, and also discuss organizational trends that are likely to affect patterns of use in the next five years.

Finally, in Part VIII, we discuss the organizational and legal policy choices that American society needs to weigh in responding to the debate over machine monitoring of VDT work. We include in this section examples of "fair work measurement" standards that we saw being applied at approximately 10% of the sites we visited, and note the parallel to the "fair information practices" developed in the 1970s by privacy experts, law, and organizational codes for handling personal data in the first era of EDP-based automation.

II. RESEARCH SOURCES

Our primary source of empirical data for this report is a two-year field study of "The Workplace Impact Of Using VDTs In The Office," conducted by the Educational Fund for Individual Rights between 1982 and 1984. That study looked at the uses of office systems technology by business, government, and non-profit organizations, focusing on issues of employee and labor relations, ergonomics, health and safety, organizational-change developments, EEO aspects, and legal and regulatory dimensions.

Confidential on-site visits were made to 110 organizations, where interviews were conducted with approximately 1,100 employees using VDTs and 650 managers and executives. (Fourteen percent of these sites were union-represented in some or all of the organization's operations.) Interviews were also held with staff members of 40 U.S. labor unions (32 of which are active on VDT issues). A pilot survey was conducted with 55 EDP and MIS directors involved in OA activities in their organizations. Human resources managers in the banking industry were surveyed on VDT issues. And representatives of women's rights, minority, business, and vendor groups were interviewed, as well as leading academic experts and private consultants. In addition, the project examined published literature in the general press, and in social-science and legal publications. Visits were also made to examine VDT issues in Canada, Britain, France, Switzerland, West Germany, and Sweden.*

Employer monitoring of workers using VDTs was one of the topics under employee and labor relations that we covered in the site visits and interviews we conducted for the study. (For the way in which this issue was handled in employee interviews, see the discussion in Part VI, section F.) In addition, after our VDT field study was completed, we conducted two additional research activities — a survey of data security specialists and a collection of materials on OA policies and practices by federal agencies -- and in each of these, several questions on employer monitoring of VDTs were included.

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* The reports of this study will be published in 1985 in two books: The Office Automation Controversy, a presentation to general readers, and The Changing Workplace: A Guide to Managing the People, Organizational and Regulatory Aspects of Office Technology, a volume directed primarily at organizational leaders. Both books will be issued by Knowledge Industries.

Several important points about our data collection on VDT work monitoring need to be emphasized at the outset. First, we approached monitoring of VDT workers not as an independent problem but as part of the total workplace context, closely interrelated with considerations of job design, ergonomics, health and safety concerns, employee and labor relations, and job security. While the way that work standards are being set and performances are being evaluated can be usefully examined as a particular employer policy, our judgment is that how employees respond to various management monitoring practices and their impact on workers is deeply affected by both objective working conditions and the quality of employee-employer relations at each workplace. Our research strategy was based on that judgment.

Second, our field study deliberately adopted an "observational" rather than "scientific" research strategy. Because we were examining so many different kinds of industries, occupational categories, OA applications, subunits of organizations, and so forth, in an environment of rapidly changing technology and its applications, we concluded that using a standardized survey instrument, even with adaptive variations, would not capture the broad range of developing experiences and emerging attitudes we were seeking from employees and managers. We also believed that there could be distortive and prompting aspects of using a formal questionnaire. Therefore, we chose to use a "conversational" topic checklist, in our employee interviews, designed to let the individual's experiences in using VDTs emerge in a "self-nominated" fashion.* Also, while most of our employee interviews were with individuals, about 15% were with employees in small focus groups. We found that holding some group interviews with four to seven participants often helped to stimulate better discussion than one-on-one sessions. These employee interviews were held with no members of management present, and under pledges of full confidentiality.

Finally, our 110 sites were not a representative sample of American office installations in general, or samples of particular subsets of that world (corporations, law firms, federal agencies, etc.). Organizations were chosen because (1) they were publicized in the computer, business, or general press as being innovators in using OA; (2) they were nominated by vendors as organizations developing interesting applications; or (3) they were cited by unions, OA consultants, academics, and other sources as having particular organizational approaches worth examining: good employee involvement programs, good health and safety policies, unfairly heavy production standards, etc. To provide a diversity of organizational sites, we chose to visit approximately 60% corporations and 40% government and non-profit organizations, to provide the basis for some broad inter-sector comparisons. We also found, as the office automation literature clearly indicates, that OA applications and policies are highly decentralized at this stage of technological development. This means that there are significant diversities among sub-units of the same organization, by individual organizations within each industry or sector, and among the three sectors we studied.

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* We used a "topic checklist" for these interviews, made up of neutrally-worded, "lead-in" questions. These included: how long the employee had been using VDTs; whether they had done this job previously without a VDT; what kind of training for the machines they had received; how the VDT affected "their job" and "their work"; what problems, if any, they had encountered using the VDT; whether they had raised these with management; how they saw their future job here or elsewhere affected by their VDT skill; how management supervised their performance; whether they had read or heard anything about "VDT issues"; and similar broad rather than highly-focused questions.

Given these conditions in the OA environment, and the research strategy we adopted, we did not try to amalgamate date obtained from visits to these 110 individual sites (sometimes of a sub-unit, sometimes to many units within one organization) to create summary percentages. In our two forthcoming reports, and in this OTA paper, we use broad statements such as "almost all," "most," or "only a few" to report most of our site visit findings. We will provide numerical estimates in a few areas, but even here with qualifiers such as "about 10%" or "in the 75-80% range." We believe this is the only responsible way to treat the exploratory research procedures and the suggestive conclusions of our study.

One other point about our empirical sources should be noted. Our site visits were made under a promise of anonymity for the organizations studied and persons interviewed. Following that promise, we present unidentified organizational vignettes and quotations. However, where we were able to obtain identified organizational accounts and personal interviews from published or archival sources that paralleled what we found, we have included such materials in a number of places, to provide useful corroboration.

III. OUR CONCEPTUAL FRAMEWORK

A. Applying a "Privacy" Analysis

Our focus in this report, as provided by the OTA contract, is on the privacy aspects of VDT work monitoring. Privacy is usually defined as the claim of individuals to determine what information about themselves is communicated to or obtained by others, and under what conditions.[1] (And, when such a claim is recognized by law, it becomes an enforceable "right" in society.)

In the context of office work, the privacy issue raised by VDT work monitoring is whether the collection of individual-operator performance data through "machine capacities" and its use to evaluate employees constitutes an intrusive form of "employer surveillance" that violates reasonable expectations of personal privacy by the employee. Some observers believe that "machine monitoring" is not really a "privacy" question at all, and that privacy concepts are inappropriate to apply. They stress that an employee's work is done on the employer's premises; that the activities are usually group settings open to view, rather than individual activities taking place in closed or private rooms; and that collecting quantitative data as to employee output has long been used in evaluating and compensating work performance in factories and offices.

We believe a "privacy analysis" in this report remains appropriate, however, and for three basic reasons:

1. "Intrusion on privacy" is one argument being used by union leaders, women's rights groups, civil liberties organizations, and many social commentators to criticize machine monitoring, and the attack on "Big Brother surveillance" has been featured in mass-media stories. Therefore, it is appropriate for us to examine the bases for applying such terms in this report.

2. Balancing organizational and social interests in collecting individual data against the individual and social interests served by privacy rights has become the heart of a "privacy-impact" analysis. This involves weighing the effect of data collection or surveillance on interests of individual dignity, psychological and physical well being of individuals, and their basic due-process interests in uses of personal data. Examining whether such a privacy-impact analysis can be usefully applied to the VDT monitoring issue, and whether this is a newly-emerging "reasonable expectation of privacy," represents an important question for the OTA assessment to consider.

3. Finally, since our conception of a privacy analysis is the kind of broad inquiry just mentioned, the materials we will present can be used in any evaluation of the pros and cons of machine monitoring -- whether this is considered as a matter of privacy, employee relations, ethical employer practices, or power struggles involving workers, unions, and managements.

B. Defining Work Monitoring

We will be using the broad term "work monitoring" to refer to employer observation or measurement of individual employees or groups at their workplaces, for purposes of determining the quantity or quality of work and using this for personnel-administration purposes. We distinguish this employer activity from the use of watching, listening, or photographing at workplaces to provide security for persons or property; or to investigate alleged incidents of employee misconduct under management disciplinary rules; or in cooperation with law enforcement authorities investigating alleged criminal activity by employees. Those kinds of employer conduct are sometimes lumped together under discussions of "surveillance at the workplace," but this confuses rather than helps sound analysis. We will be discussing how non-personnel-administration surveillance has been treated legally, for the possible relevance of those policies for VDT work-monitoring issues. But our clear focus in this report -- and the one most relevant to office-automation -- will be on new techniques of machine-based work monitoring for personnel-administration purposes.

Also, though we will describe how we found work monitoring beginning to be used for professional, sales, and management employees, we will be concentrating our attention in this report on clerical-level jobs. These represent the largest applications of VDTs to office work; the most intensive uses of VDTs, in terms of hours per day on the machines; the types of office work that were most quantitatively measured before OA arrived; and the jobs using VDTs to which machine-based work monitoring is being most widely applied today. These VDT-based clerical jobs involve four main areas of work activity: data entry, claims processing word processing, and customer-service.

Another important distinction should be noted. In the factory setting, work monitoring involves employer observation of physical actions; this was paralleled in the pre-OA office by employer monitoring of such office activities as typing, copying, filing, mail-handling, and business-machine work (adders, sorters, keypunch, etc.). However, the arrival of the telephone in the late 19th century provided a major office activity in which employees used the telephone to provide service to organizational customers. Here, issues relating to the privacy interests of persons outside the employer-employee relationship came into play. As we will see, those third-party interests produced a separate set of legal concepts and policy issues in the pre-OA period, and these also need to be considered in the OA era.

Finally, we will be discussing the fact that the great majority of the work monitoring being done on VDTs involves women clerical workers, who make up 80-99% of the occupational groups in our four categories. Employers have argued that women clericals are more accepting of production monitoring, welcome the "feedback," want incentive pay arrangements so that they can earn more for repetitive, "go-nowhere" jobs, etc. Women's rights groups and unions active in representing or organizing women office workers contend that -- if such clerical women's attitudes were ever willing choices -- they do not represent the current feelings of most women working on VDTs. Therefore, when we get to the current, post-1980 work monitoring scene, we will be analyzing "women's issues" as a relevant topic in work monitoring.

C. The Historical and Social-Policy Milieu of Work Monitoring

Setting production standards for a job, measuring the output of workers, and using such measurements to judge performance is a management activity as old as organized work itself. It was done in the ancient world in mining and building; it was part of artisan and clerk supervision in the mercantile age; and it became a central aspect of industrialization, especially in the "scientific management" approach of Frederick Taylor and his disciples.

In every era, work measurement brings to the fore a classic tension between employers and employees. There are conflicting interests in the quality and rate of work set as a norm, the rate of pay, the way in which supervision of performance is accomplished, and whether individual or group output is used to determine pay or promotion. The constant introduction of new technologies in modern societies leads to continuous debate over fair standards and fair measurement techniques, as work settings in factories and offices undergo major changes.

In practice, the standards and measurement techniques applied by management reflect many factors: prevailing social and cultural values, current theories of mangement, expectations and perceptions of employees, the state of the labor market, collective bargaining in unionized organizations, and, in some areas, regulatory and legal controls. In economic terms, managements in modern, advanced-industrial societies have to balance their interests in expanding productivity with an awareness that work standards and measurements techniques that employee consider unfair can harm employee morale and commitment, create physical and emotional stress, increase absenteeism and turnover, generate employee sabotage and generally impair the increased productivity the employer is trying to achieve.

Similarly, employees reacting to production standards today have to take into account the viability and survival of their employer in a competitive world, and the possible peril to their jobs if work is not produced in sufficient quantity or if the quality of the work is not good enough.

The social policy questions as to work monitoring are roughly similar to those presented in other privacy settings, such as wiretapping, computerization of credit records, or use of polygraph testing. In work monitoring, society has to decide: (1) whether to leave the setting and applying of work standards to private resolution (through labor-management negotiations in unionized settings or, in non-union settings, to an assumed "labor market" effect on the attracting and keeping of good employees); (2) whether to ban certain types or uses of work monitoring completely, as so subject to abuse and so destructive of employee dignity that it should not be allowed; or (3) whether to allow work monitoring at the employer's discretion, but set conditions on its use, intended to protect employee privacy, health, or other interests while still allowing "proper use" to employers as an important productivity and work-quality tool.

IV. THE PRE-OA BASELINE, 1945-1970

A. Introduction

In the period between the 1880s and 1945, in both factories and offices, craft-based production and employee discretion in performing jobs were replaced by machine-assisted work and scientific management approaches. These brought increased division of labor, specialization of tasks, and organization of work around efficient utilization of mechanical (and then electrical) machines. Under the influence of Frederick Taylor and his counterparts in industry, time-method-and-motion studies were applied to identify and then enforce an efficiency-based, "one best way" to perform those tasks for which the applications of new industrial and office machines had produced routine, repetitive, and simplified work operations. The story of how this became the dominant philosophy in factories, and how the same ideas were applied by Leffingwell and his disciples to routine clerical functions in office work, has been well and often told, from a variety of ideological perspectives.[2]

The twin pillars of "scientific management" were observation and measurement. Time and motion engineers, armed with stop watch, chart diagrams, and clipboards, moved through shops floors and office buildings in the early 20th century, applying their techniques not only when major new technologies were introduced but also on a continuing basis, as changes in business or government services, improvements in machines, and changes in physical work environments called for new studies of "the best way" to do each task. This process put workers under physical observation; it also required measuring worker output -- number of widgets produced, lines typed, letters sorted, orders entered by telephone, claims processed, etc. This was done first to set a "work standard," and to keep revising it for maximum output; then, to record each employee's daily or weekly output, to see if the standard had been met or exceeded, or whether the employee had failed to "make standard."

While "scientific management" was the dominant approach in both industry and offices from the early 20th century through our baseline period, one important difference among industries and government sectors was in whether such work standards and output measurements were used as the basis for incentive payment systems (a "base" wage plus "bonuses" for exceeding "standard"), or only to identify poor performance of individual employees, leading to additional training, warnings, or discharge if work continued to fall "below standard." In industries where stimulating individual effort was seen by managements as having a significant effect on production rates, as in clothing and steel, incentive pay systems were widely used. In other industries, where continuous process production or assembly lines limited the ability of individuals to affect the pace of producing, as in chemicals or autos, incentive pay plans were used less often. About 25% of manufacturing employees were estimated to have been covered by incentive pay plans in the United States in the 1945-1970 period.[3] We do not know of similar authoritative figures for office clerical work, but it has been shown to have been applied in typing, filing, and machine-operating departments.[4]

The position of labor unions toward the form of scientific management expressed by "Taylorism" was one of uniform opposition.[5] The "stop watch man" was the living symbol to unions of unfair "speed ups" of work pace, lowering of wages for jobs so measured, creation of routine and "mindless" assembly-line work, and the tightening of authoritarian "management control" over workplaces. Because new technology was applied by management to simplify work, and because unions saw this as reducing the "craft" element that gave skilled workers their bargaining power, applications of new technology were often attacked or resisted by unions as "dehumanizing" the workplace.[6] However, there was considerable variation among unions in different industries in their approval or disapproval of new technologies, depending largely on the impact on job levels and industry growth.[7] The overall position of American trade unions toward new technology in our baseline period was one of positive acceptance, given the prosperous economy and good employment opportunities of this era, with union efforts focused on safeguarding the interests of existing and future workers in how such technologies were applied.[8]

As to incentive pay plans, some unions, such as the Machinists, have been bitterly opposed to such systems; their position is that pay should be for satisfactory achievement by the work group or unit, with the individual employee's pay per hour set under collective bargaining agreement by specific job classification. Other unions, such as the Steelworkers and Electrical Workers, have supported incentive pay plans, because the workers they represent like the system offered by management and it was being fairly administered.[9]

Although unions are able, under American labor law, to bargain with managements about many aspects of work, wages, health and safety in work operations, discipline, and discharge, there is usually a "management's right to manage" clause that reserves to the employer the right to determine the "method and means by which its operations will be carried out."[10] Unions may attempt to win limits on or specifications about work monitoring practices through negotiations, but managements can refuse to agree to those, citing the "management rights" clause, and this has generally been upheld by arbitrators. (See sections C and D in this Part.)

B. Office Work and Monitoring Practices

In the 1945-1970 period, measurement of output for quantity and quality was commonplace for many office clerical jobs. In terms of quantity, keypunch operators and data entry workers using VDTs in the 1960s were measured by keystrokes. Typists in typing pools were measured by lines, pages, or documents completed. Accounting and inventory clerks and claims processors were measured by units completed in a day or week. Generally, this measurement was achieved by supervisors counting products produced, or verifying production reports filled out by the employee. For such jobs, quality checks were made of errors committed, and if these went above the allowable number for a given task, there could be warnings or discipline, or loss of "bonus" pay if an incentive pay system was in place.

As far as watching how these clerical employees worked at their jobs, observation by supervisors was the common technique. The academic literature on office work in insurance companies, banks, and other "clerk intensive" businesses contains many critical descriptions of "close surveillance" by supervisors — "always watching" accounting clerks, pool typists, tellers, etc. and aggressively monitoring their compliance with work procedures and output quotas."[11] However, we have no estimates of how many workplaces had supervisor monitoring that was offensive to employees in this period and how many had practices that were considered fair and acceptable. Presumably, the low levels of unionization among clerical workers and the absence of public protests or calls for legislation are some indication that visual supervisory monitoring was not regarded by most office workers as an intolerable practice.

The critical aspects of individual monitoring of highly-routinized clerical jobs in the pre-OA era was that direct, visual supervision was necessarily occasional (supervisors couldn't be everywhere at once and TV monitoring was not used in offices); also, except for situations where mechanical machines or EDP-data entry systems recorded employee output automatically, record-keeping was not a total and continuous process for clerical workers.

Telephone work, both for the telephone companies and in the customer-service operations of business and government organizations, fell into a different category. Since the early days of the telephone companies, and at least since the 1930s for business and government organizations, the performance of telephone operators had been subject to what was called "service monitoring."* This consisted of regular sampling by supervisors of telephone conversations between individual employee operators and members of the public seeking service from the organization. All of the telephone companies operating in this period acknowledged using service monitoring. Business and government use was widespread; an AT&T spokesman estimated (in 1974) that about 4,000 to 4,500 business and government customers were renting service monitoring equipment from Bell telephone companies to monitor the performance of their telephone operations.[12] Looking over lists of such customers produced in hearings before regulatory commissions and legislative hearings in the 1960s and early 70s, the major business and non-profit users included:[13]

Airlines
Utilities
Hotels
Newspapers and large magazines
Retailers/department stores
Credit bureaus
Hospitals
Banks
Insurance firms
Collection agencies
Charitable groups
Religious bodies

Among major government users were federal agencies such as the Internal Revenue Service; Veterans Administration, Social Security Agency, General Services Agency, Marine Corps, and federal Job Information Centers. Many state, county, and city agencies with high-volume telephone operations were also users of service monitoring.

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* The telephone companies have used "service observing" to refer to random mechanical checks on the quality of transmissions, connections, and response times of the equipment itself, while using "supervisory observing" to refer to a supervisor listening in to customer-service calls to the telephone company to see how well individual telephone employees are performing. In public discussion and legal proceedings, the term "service monitoring" has been the one generally used for the employee or work monitoring, however, and thus we will use "service monitoring" in this report.

The telephone companies stated that their use of such monitoring was under careful and proper rules. "The sole purpose of supervisory observing is to determine what further individual assistance, training, and development, if any, is required /for the individual employee/. It is purely supervisory in nature and is not designed for disciplinary purposes. By charting individual progress, it not only discloses critical areas which require attention but also affords a means of recognizing satisfactory or outstanding performance." Employees were notified that such monitoring was being done, the telephone company noted, and the specific results of monitoring were discussed between supervisor and employee.[14] As far as invasion of the employee's privacy, the telephone company noted that personal calls by employees were never monitored; telephones for making such calls were provided in employee lounges and never monitored. And, since the customer is talking to an operator in these situations, no telephone conversations between members of the public are involved.[15]

As far as the types of service-quality checks that the company used monitoring to examine, the telephone company gave as examples the following evaluative items:[16]

> - Did the business office service representative determine the type and color of telephone equipment desired and correctly establish the time and place of installation?
>
> - Did the directory assistance operator provide the desired number promptly, accurately and courteously?
>
> - Did the plant repair clerk obtain sufficient information about the service trouble, so that proper testing could be carried out and an access time negotiated in the event it became necessary for a repairman to visit the customer's premises?
>
> - Did the long distance operator handle the person-to-person call properly?

Rental by the telephone companies of various kinds of key equipment, and special switchboards to organizations for monitoring their own telephone operators was done in this period under a set of explicit rules, agreed to in writing by the customer.[17] These provided that employees of the customer must be informed that their business telephone contacts are subject to observation; that such service is provided "solely for the purpose of determining the need for training or improving the quality of service rendered by employees in the handling of telephone calls to the subscriber of an impersonal business nature;" and that, when used by hotels, motels, and clubs, observing may not be done in conversations between guest rooms.

Representatives from business and government organizations using telephone service monitoring testified before various hearings that they abided fully by the rules set by the telephone companies, and that conducting such observations where the telephone was the key to their operations was a vital part of assuring that their customers received efficient, correct, and courteous service. The position of Pan American World Airways and the sample of a telephone monitoring report that they used will illustrate the business and government descriptions of their purposes and practices.[18]

> Pan Am maintains Quality Assurance programs in all facets of its operations to assure safety and service, convenience, and economy for both the company and its customers. Telephone call observing is part of this quality assurance program, but is confined to our Telephone Sales Departments, or, as commonly known, "Reservations".
>
> The company policy is that each of our employees, whose job function is selling or servicing Pan Am's product by telephone, shall be observed a minimum of two times

> per week, and that observations shall, on each occasion consist of a complete telephone call. The purpose of this call observation is defined in our Reservations Manual which outlines the policies governing our reservations offices and I quote, "The primary purpose of the Quality Analysis program is to give supervisory personnel the tool with which to ensure that they and their personnel are performing their functions in the prescribed manner. Properly conducted, the Quality Analysis program will enable the supervisor to pinpoint areas where additional training and/or supervision is required in the day-to-day operation. Its end result should be to raise personnel efficiency to the level where Pan Am will realize greater economies and revenues through the minimization of errors which cause Misunderstandings, Noshows, Norecs, Late Cancellations, Misconnections and Mishandled passengers." No employee of Pan American has ever been terminated, dismissed, or suspended on the basis of a supervisor's observation through the use of telephone call observation.

An average employee assigned to a telephone sales position in the course of a month will handle in excess of 1500 incoming calls, and the average number of observations for that employee during the month is approximately 8 incoming telephone calls, making the number of calls monitored less than 0.005%. The size of the sampling for an entire office provides meaningful information as to what areas of additional training are necessary and whether we are providing adequate reference materials to our employees. The call sampling as related to the individual employee has little or no significance as a disciplinary tool. A copy of the sales quality monitoring form used in our Quality Analysis program is enclosed.

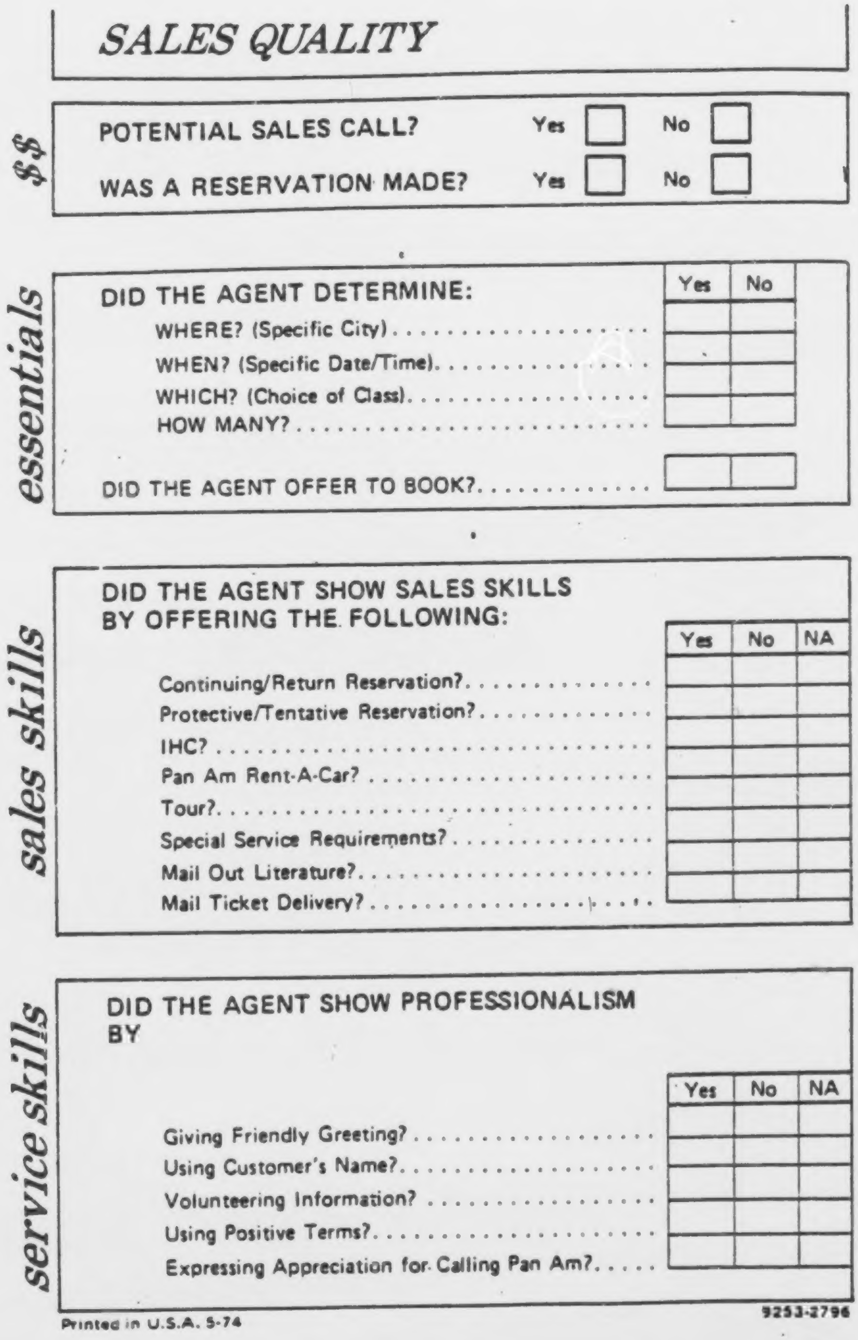
In Pan American the telephone sales personnel are unionized employees. The employees who do the majority of the call observations are in the "Lead Agent" category and also members of the union. The "Lead Agent" by contract definition, cannot discipline other employees. I mention this only to emphasize that monitoring is primarily used to improve the quality of our service, not to entrap employees.

Where call monitoring equipment is installed and used in our reservations offices, it is done so only in compliance with the existing communications regulations governing the use of such equipment.

We have experienced no strong animosity on the part of our employees directed at the practice of monitoring incoming reservations calls. Our employees are aware that monitoring is conducted and the procedures for monitoring are published in the Reservations Manual under the section entitled "Passenger Reservations Proceudres, Reservations Policies".

We feel that the vast majority of our employees recognize the need for Quality Assurance and understand that in a high competitive industry such as ours that failure to provide quality can only result in a deterioration of our markets, with the subsequent necessity of reductions in our work staff. For this reason, we believe our employees accept monitoring as a necessary supervisory tool.

PAN AMERICAN WORLD AIRWAYS, Quality Analysis Program, 1974



SALES QUALITY

\$\$

POTENTIAL SALES CALL? Yes ☐ No ☐

WAS A RESERVATION MADE? Yes ☐ No ☐

essentials

DID THE AGENT DETERMINE:	Yes	No
WHERE? (Specific City)	☐	☐
WHEN? (Specific Date/Time)	☐	☐
WHICH? (Choice of Class)	☐	☐
HOW MANY?	☐	☐
DID THE AGENT OFFER TO BOOK?	☐	☐

sales skills

DID THE AGENT SHOW SALES SKILLS BY OFFERING THE FOLLOWING:

	Yes	No	NA
Continuing/Return Reservation?	☐	☐	☐
Protective/Tentative Reservation?	☐	☐	☐
IHC?	☐	☐	☐
Pan Am Rent-A-Car?	☐	☐	☐
Tour?	☐	☐	☐
Special Service Requirements?	☐	☐	☐
Mail Out Literature?	☐	☐	☐
Mail Ticket Delivery?	☐	☐	☐

service skills

DID THE AGENT SHOW PROFESSIONALISM BY

	Yes	No	NA
Giving Friendly Greeting?	☐	☐	☐
Using Customer's Name?	☐	☐	☐
Volunteering Information?	☐	☐	☐
Using Positive Terms?	☐	☐	☐
Expressing Appreciation for Calling Pan Am?	☐	☐	☐

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strengths	IN YOUR OPINION, WHAT WERE THE MOST POSITIVE POINTS OF THE CALL? BE SPECIFIC AND LIST AT LEAST TWO POSITIVE POINTS.
suggestions	IN YOUR OPINION, WHAT ITEMS COULD BE IMPROVED? BE SPECIFIC. HOW?

REMARKS

NOTE TO SALES AGENTS:

THIS FORM WILL BE USED BY YOUR LEAD AGENT ONLY AS A TRAINING AID. IT WILL NOT BE USED TO DISCIPLINE ANY EMPLOYEE. AFTER COMPLETION AND REVIEW WITH THE OBSERVING LEAD AGENT, YOU MAY RETAIN IT FOR REFERENCE, DISCUSS IT WITH YOUR MANAGEMENT SUPERVISOR, IF DESIRED, OR, IT MAY BE DISCARDED.

*SALES AGENT*________________________

*OBSERVING LEAD AGENT*________________________

*DATE*________________________

Overall, employer monitoring of telephone service workers was used in this period as an occasional sampling technique, rather than a continuous oversight. It also did not seem to have been used as an instrument for increasing the pace of work in a way that set off employee or union protests. For example, in recent interviews with telephone company operators who were working in such jobs in the 1960s, employees remember company practices in that era as being "quality oriented," with the company's focus genuinely on insuring that good service was given to callers seeking directory assistance, equipment repair, or new telephone installations, or reporting emergencies to the telephone company.[19]

C. Unions, Collective Bargaining and Arbitration

In our baseline period, the overwhelming majority of office and customer-service workers, between 90-95%, were not represented by unions. This meant that most managements were free to apply work monitoring techniques as they wished, subject only to compliance with general laws, such as those relating to monitoring employee telephone calls with the public. (See section D.)

In the industrial sector, a few unions were able to obtain clauses in collective bargaining specifying the way in which new technology-based monitoring would be conducted. In a "memorandum of understanding" negotiated between the Machinists Union and Cutler-Hammer Company, it was specified that a productivity recording device known as "Telecontrol" would not be used as a disciplinary tool, could not be used to establish "production demand" standards, and could not be used to require day workers to work at an incentive pace.[20]

Several unions representing office workers raised anti-monitoring protests in this period, primarily involving telephone service monitoring. In 1967, the Utility Workers complained about Commonwealth Edison Company's shift from an older "double jack" system of supervisors plugging into a clerk's desk to listen to conversations with utility customers to a new telephone-company-provided system that permitted monitoring to be done from a remote location. Employees were told that "random listening-in" was used by the company, for what it said were . . .

"training and overall supervision purposes," but employees would no longer know when their calls were being listened to. The arbitrator held that the use of "undetected monitoring" was not a violation of the existing labor contract, nor did it represent a change in "working conditions" to which the union had to consent.[21]

A similar arbitration decision involved a grievance filed by the Newspaper Guild against the Boston Herald Traveler.[22] The newspaper had used telephone monitoring for its "inside classified solicitors" selling classified ads ever since 1934. This was done with equipment rented from the telephone company that provided a toggle switch at the supervisor's telephone, with which he could listen in on calls being made by each of about 30 classified-ad salespersons. The union maintained that an audible click and a lowering of sound volume let employees know when this monitoring was taking place, though this was not intended to be so by the management.

In 1966, because of a public inquiry in Massachusetts into telephone tapping and recording of conversations, the newspaper suspended its use of service monitoring, to examine whether its use of the practice was legal. (Massachusetts enacted a statute in 1968 governing wiretapping, which specifically excluded monitoring for customer-service-employee supervision from the prohibitions against unlawful wiretapping in its statute.)

In 1968, the newspaper resumed monitoring, but now it installed new console-based telephone company equipment that did not provide the classified ad solicitor (or the customer on the line) with any audible clue that anyone was listening in. All solicitors were notified of the installation of the equipment and told how it would be used.

Management stated in the arbitration proceeding that the monitoring enabled the unit supervisor to observe and train new solicitors, evaluate the performance of experienced solicitors, and learn about the effectiveness of particular "ad sales" being offered, including both the employee's "sell" and the customer's reactions to the offer and the presentation. It noted that such service monitoring had been used for several decades and was widespread in the newspaper industry, was supported by "legal and arbitral authorities," and had not been the subject of "contract restrictions" in the newspaper industry. The Newspaper Guild argued that installation of the new monitoring system improperly changed working conditions set by the contract. However, even if it was held not to offend any specific provision, the union asked the arbitrator to rule "as a matter of equity," that the publisher should either stop monitoring or limit its use to training new employees. The Guild argued, as summarized by the arbitrator, that "the solicitor's inability to tell under the present equipment whether or not she is being monitored has inevitably given rise to feelings of concern, nervousness and insecurity and has made the job of solicitor additionally and unnecessarily burdensome." However, the Guild could not point to any pattern of contract restriction at any other newspapers, or in any other industry using such telephone monitoring.

The arbitrator upheld the newspaper's use of telephone monitoring. The opinion explained:

> The very essence of the work of a solicitor is talking on the telephone. As the employer, the Publisher is, of course, entitled not only to supervise the work of its employees but to adopt reasonable measures which will best effectuate that supervision. In general, such supervision would necessarily entail the training of new and inexperienced employees, observing the day-to-day perform-

> ance of both inexperienced and experienced employees, evaluating their performance and determining ways and means for improving it. In the context of the particular type of work being done by inside solicitors, namely, telephone soliciting, the essence of the performance is a matter of technique -- how best to accomplish the selling of the Publisher's product, in this case classified space, under the limitations imposed by the use of a telephone in contrast to a face to face confrontation.
>
> It would seem that, of necessity, the only reasonably effective way in which telephone work can be supervised is by monitoring the calls being received or made by solicitors. It obviously cannot be done merely by visual observation for clearly it is the content of what is said and how it is said that determines the effectivenss of the solicitor's technique and performance. While especially true in training and supervising inexperienced employees and in the case of special promotions, it is no less valid in evaluating the overall daily performance of each solicitor.

The arbitrator noted that telephone service monitoring was specifically exempted from Massachusett's new anti-wiretapping statute, indicating a legislative approval of such employer practices. In addition to citing the earlier ruling in the Commonwealth Edison case approving exactly the telephone monitoring protested about here, the arbitrator cited a 1966 decision allowing an employer to install closed circuit television for personnel supervision, and quoted approvingly from the opinion in that case:[23]

> The use of television to watch employees concerns the subject of supervision. A decision as to how employees are to be supervised and what are the proper methods of supervision is a normal function of Management. Nothing in the Agreement suggests that this function can be exercised only with the prior consent of the Union. Management has the right to change its methods, procedures and operations without "mutual agreement" -- so long as the change does not result in a contract violation.

In closing, the arbitrator stated:

> If there are particular considerations in the circumstances of the instant situation which might suggest some restriction in the way in which the Publisher exercises its right to monitor calls, we do not believe that they are sufficiently compelling to warrant their being imposed by arbitral decision. They are more properly addressed to the bargaining table.

In case of physical observation of workers, rather than telephone monitoring, union protests and arbitration cases in this period involved industrial rather than office sites. The general rule adopted was that employers could -- under the management rights doctrine -- install closed circuit TV, either for general supervision, to study the performance of incentive workers, or when thefts and inventory shortages made such use important to the employer, as long as this was not expressly limited in the contract.[24] In one case during this period, however, an arbitrator held that the employer had violated a "maintenance of working conditions clause" by installing a closed circuit television system on the production floor, where no specific problems of supervision or operations had arisen to justify such a change in observation techniques.[25]

Another area of controversy in this period involved the special situation of postal workers. The Postal Workers Union protested the continuous use of hidden "lookout galleries" in U.S. Post Offices; these were justified by postal authorities not for work supervision but as a long-standing measure necessary to prevent theft of valuables in the mails. Postal Union complaints were not successful, and the lookout galleries continued to be used.[26] (In Canada, the Canadian postal union won an agreement in their 1964 contract that the post office would not use individual work monitoring for full time employees, but would limit this to trainees.[27] This was not achieved by the Postal Union in the U.S.).

In only one area did arbitration decisions in the industrial sector hold out a promise of useful doctrines for unions in the office sector. Under federal labor law, it was an unfair labor practice to use performance monitoring or observation in a discriminatory way against union members or officers, or employees trying to organize a union; attempts to use such monitoring to justify discipline or discharge of those employees for failing to perform adequately were struck down by arbitrators.[28] Where work monitoring was believed by office-worker unions to have been applied in such a fashion, grievances could be filed and there would be relief in arbitration if the facts supported that contention.

Summing up the situation in our pre-OA period, collective bargaining patterns and arbitration rulings gave managements almost unlimited rights to employ work monitoring as they saw fit. A few office unions tried to negotiate contract limitations or convince arbitrators that management should consult with unions in their monitoring practices, but these were unsuccessful.*

D. The Judicial, Legislative, and Regulatory Setting

There were no constitutional limits placed on either government or private-employer uses of work monitoring in this era, and no common law doctrines gave employees legal recourse against such employer action. Legislative consideration came in one area, telephone monitoring. Because of widespread public concern over wiretapping, Congress and half a dozen state legislatures included in their examination of how to deal with telephone tapping a consideration of whether the random and unrecorded listening in by employers on customer conversations threatened public rights to the privacy in such telephone use. In Title III of the Omnibus Crime Control and Safe Streets Act, and in state anti-wiretapping laws, legislators decided that such employer monitoring was not an unreasonable intrusion, and service monitoring was expressly authorized in all such statutes.[29]

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* In 1967, the Newspaper Guild adopted a collective bargaining demand for "elimination of secret surveillance of employees as well as the use of electronic supervisors, tape recordings, telephone monitoring systems, and similar procedures and devices." Testimony and Exhibits of the Newspaper Guild, U.S. Department of Labor, Workplace Privacy Hearings, December, 1979. This does not seem to have been achieved in any contract negotiated by the Guild.

Two state public utilities -- in California and Georgia -- responded to anti-monitoring campaigns by the Communication Workers of America by issuing regulations in this period governing how telephone monitoring could be conducted by employers, including the telephone companies.[30] In its 1974 convention, the CWA had reviewed what it considered a long history ("65 years") of "controversial" service monitoring, cited recent abuses of this for disciplinary and termination purposes, and noted the inability of the CWA to do much about this through repeated grievance filings or collective bargaining demands. Therefore, the CWA resolved to strengthen the campaign it had begun in the late 1960s to get public utility commissions to issue regulations on service monitoring; to seek intervention by the U.S. National Wiretapping Commission (then holding hearings on administration of Title III); and also to seek state legislation banning or limiting monitoring.

CWA's first partially successful effort at regulation had come in 1968. Reflecting concern for customer privacy and employee relations, but also finding that service monitoring was important to insure "efficiency" and "quality" in telephone service to the public, the California PUC ruled in 1968 that employers could monitor if (1) one of four techniques of audible tones or notices was adopted; (2) no notations were made of the contents of the telephone conversations; and (3) notations about employee performance were used only for training and quality-control purposes. Over 1,000 employers were using employee service monitoring in California at that time, but the number dropped to 578 by 1974, after the PUC rules were issued.[31] In 1971, after new CWA charges that monitoring was being used by Pacific Telephone to discipline employees, the California PUC added a rule that information on employee performance obtained by supervisors through monitoring could be used for discipline only if the employees involved were given notice of monitoring procedures.

In 1974, Georgia's PUC held hearings in response to CWA complaints. It ruled that employee monitoring could be done only if a visible, bright orange label was placed on the monitored phones of employees and an asterisk was placed in the telephone directory indicated that service monitoring was being done on that line, to inform customers of such conduct.[32]

E. The Social Climate and Public-Opinion Orientations

Though concern about invasions of privacy had begun to rise in the 1960s, with exposure of new technologies for physical, psychological, and record-surveillance and their growing uses by organizations, public opinion surveys showed that only a third of Americans were concerned before 1975 about threats to their personal privacy.[33] In addition, the employment relationship was still treated in public attitudes as one in which employers had very wide and legitimate latitude to set work standards and performance measures as they wished. The only limitations in this period were the rights of workers to join unions and compliance with new equal employment opportunity laws (such as Title VII of the 1964 Civil Rights Act). Individual-employee rights -- separate from collective rights for union members or group rights for members of minorities -- had not yet moved into public or legal recognition, as they would in the next decade. Some social critics and unions attacked exploitation of clerical workers by employers who paid low wages, set high production quotas, and supervised their employees in "oppressive" ways. Judged by the actions of society in this period -- low unionization of such employees, despite union organization efforts; the absence of regulatory or legislative intervention; and non-intervention by the courts under common law or constitutional authority -- it seems accurate to say that dominant public opinion between 1945-1975 assumed that most office work was being measured and most individuals were being evaluated in ways that did not call for social interventions against existing employer practices.

V. A TRANSITION PERIOD, 1975-1980: NEW TECHNOLOGY, NEW EMPLOYER PRACTICES, AND NEW SOCIAL VALUES

A. Introduction

The late Seventies was a time of significant change in how work was managed and technologies were applied, along with powerful changes in social attitudes toward individual-employee and women's rights, and toward the use of social interventions to protect such rights. Had OA unfolded in the Eisenhower era, the interaction of technology and society would probably have been tranquil. However, the fact that it was the end of the Seventies and the early Eighties when OA moved significantly into office work helps to explain much about the current controversies over VDT work monitoring.

B. Technological Changes and Employer Practices

By the late 1970s, automatic call distributing systems (ACD) made on-site, silent monitoring of telephone-based office work cheaper and easier. Simultaneously, introduction of touch-tone dialing allowed the telephone company to listen in on operator performance remotely, from off-site telephones dialing up a secret access code. Federal and state government agencies, business employers, and non-profit organizations whose operations depended on high-quality customer service by telephone continued to be active service-monitoring users, and newspaper stories periodically featured accounts of 4 to 5 thousand known employers engaged in such activity.[34] As we will see, this produced union protests, arbitration rulings, and some governmental activity. Concern over the use of monitoring to speed up telephone-operator performance unfairly paralleled factory-union protests in this period over the use the new numerically-controlled machine tools in industry to pace and monitor production work in ways that industrial unions said were "unfair speedups."[35]

In non-telephone office work, large non-union companies and government agencies split into two camps in this decade in their administration of repetitive clerical and white collar work. The dominant trend remained the Taylor-based close supervision approach applied to production-based office operations, such as data entry, units, typing pools, and customer-call work. However at a minority of organizations, new "human resources" approaches to administering office work were beginning to be adopted that downplayed close visual supervision and recording of production output. Rather, employee-manager performance appraisals were developed that identified quality as well as quantity goals and used these to determine individual merit pay and promotion decisions. In his study of Personnel Policies in Large Nonunion Firms, in the late 1970s, Fred Foulkes documented the trend to such approaches in the "progressive" manufacturing and non-manufacturing firms he studied.[36]

Some idea of the distribution of employer practices in the 1970s can be inferred from a national opinion survey on productivity conducted by Louis Harris and Associates in 1979 for Steelcase, the office furniture manufacturer.[37] 1,004 workers in offices with more than 25 employees were interviewed, with 60% of the sample consisting of clerical, secretarial, accounting, bookkeeping, and similar support-worker employees. (The remaining 40% were professionals, managers, and executives.) One question asked:

"As you may know, for many years people in jobs like manufacturing, farming, sales, and construction have had their productivity measured by how much work they produce in a given period of time. Have you personally ever had a job where how much you produced in a given period of time was measured?"

Among secretaries, only 27% said they had been in such a job, while 73% answered that they had not. Among clericals, 43% said they had been measured and 57% said they had not.

The executives in the survey were also asked whether their company "has attempted to measure how much work is produced in a given period of time by its office workers?" 45% of the executives said their company had done this, 50% said it had not, and 5% were not sure.

These responses do not clearly distinguish occasional productivity studies or setting general work standards from continuous monitoring. Nor do they tell us how such measuring was tied to pay, promotions, or discipline. However, Harris-Steelcase survey is useful in suggesting that less than half of clerical workers and only about a fourth of secretaries in business offices seemed to be working under any form of formal out-put measuring systems in this period.

C. Changing Social Attitudes

Major changes in social attitudes took place in the late 1970s related to our topic. After Watergate, exposures of Army, FBI, and CIA surveillance of dissidents, and concern over databank developments in handling citizen and consumer records, Americans stating that they were concerned about invasions of their privacy rose from a third in 1970 to 64% in 1978, as reported in a large-scale privacy survey conducted by Louis Harris and Dr. Alan F. Westin for Sentry Insurance in 1978.[38] In the area of employment and privacy, the Sentry survey found that strong majorities of the public -- and of full-time employees -- believed that it was no longer proper for employers to ask job applicants about many topics that had once been traditional to collect. These included: information about an applicant's spouse; the applicant's neighborhood; membership in organizations; whether applicants own or rent their residence; whether applicants have been arrested but not convicted; and similar matters.[39]

On work monitoring, 66% of the public and 69% of employees believed that "installing closed circuit television to obtain continuous checks on how fast workers perform" should be forbidden by law. (51% of employers believed it should not be forbidden, 45% felt it should, and 4% were not sure.) However, only 42% of the public and 43% of employees believed that such closed circuit TV should be forbidden when employers use it "to prevent theft and pilfering by employees." 77% of employers believed such use should not be forbidden. When asked about employers "listening in on the conversations of employees to find out what they think of their supervisors and managers," 83% of the public, 84% of employees, and 70% of employers believed this should be forbidden.[40]

Reflecting such concerns and attitudes, the 1970s brought major federal privacy legislation (the Federal Privacy Act of 1974, the Financial Right to Privacy Act of 1978); similar fair-information-practices laws in half a dozen states; laws in sixteen states forbidding employers to use polygraphs for hiring or as a condition of continued employment; and legislation in half a dozen states giving employees the right to examine their personnel records and setting rules for disclosure of employee personal data to third parties.

Simultaneously, the women's rights cause became a growing, organized movement in the 1970s. Fair employment practices, the treatment of women in clerical jobs, and the impact of office automation on women's economic and social interests became central themes on the women's rights agenda. In 1978-80, articles, monographs, and public testimony by leading women's activist groups zeroed in on office automation as a menacing trend for women. The leading publication in this critique was Race Against Time: Automation of the Office, by Judith Gregory and Karen Nussbaum, issued by Working Women, the National Association of Office Workers, in 1980.[41] Machine monitoring was a key issue discussed in this report:

> The first step towards the office of the future is to apply the principles of factory production to office work. The move to electronics finally gives managers "a way to enforce discipline and standardization in the office," explained one participant in a recent brainstorming session of computer vendors, users and consultants. A "bonus" of

> office automation is that "business can finally monitor and measure the clerical function," according to Donald C. Vednais of the 3M Corporation's Business Communications Products Division. In fact, companies can "eliminate unnecessary managerial layers" of supervisors "whose primary activities are monitoring others" by using machines designed to measure the output, speed and errors of each employee. "The real payoff comes because managers are able to widen their span of control" -- to increase the number of subordinates they can manage.
>
> Many computerized systems are designed to make it easier to enforce production quotas and the speed of work. "Automatic call distributors", for example, are widely used in the insurance industry and in other companies with departments where clericals "process" phone calls from customers. The device simultaneously tallies the number of calls each clerk handles, measures the average delay in answering calls, and counts the calls lost by the switchboard after 30 seconds of ringing. Time standards often set the pace for every clerical job within the insurance company: "coding each A-type claim is allotted 4 minutes, a B-type claim 4.7 minutes. Each clerk keeps a running record of the work she does on a production sheet" by task and day of the week. Computer terminals used by data entry operators record the number of keystrokes per minute and lines processed per day. Many of these "input typists" are paid piecework rates rather than an hourly wage. For claims processors, each claim is coded with the employee's name. The computer rejects any inaccurate forms, keeping track of the number of mistakes along with volume and speed.
>
> All of these measurements become part of each employee's work record, often without his or her knowledge. While many clericals today have to write down what they do on weekly clipboards, more and more of these time-study calculations will be computerized. Many more clericals will be monitored and measured for the first time in the near future.

The significance of women's activist groups taking up the office automation issue was that it brought a potentially powerful ally to the union cause. Since unions had enjoyed limited success in organizing women clerical workers, and most organizing was still the male-dominated, old-line-issue approach that had not appealed to most women clericals or professionals in offices, the joinder of women's activist groups in protesting against what they considered harmful uses of office technology --

including work monitoring practices -- broadened the "union case" into a protest that would reach the mass media in the early 1980s.

Finally, American attitudes toward the employment relationship itself underwent major change in the late 1970s. With employment the key to health insurance and retirement benefits in a non-socialist society, with EEO enforcement and occupational health and safety protection now major public programs, and with an awareness that union representation covered only one employee out of five, and was not expanding, employees and the public began to be concerned that employers would not treat workers in arbitrary and authoritarian ways, and that there should probably be "some remedies" against employers who did so. As we will discuss in the next three sections, this shift from support of employer prerogative to an expectation of employer responsibility would begin to affect employment law and regulatory trends in significant ways.

D. Union Positions, Collective Bargaining, and Arbitration

Union activity in the late 1970s reflected labor charges that managements in many industries were increasingly using machine-based pressures to produce faster work. The position adopted by unions was that speedups, enforced by close work monitoring, were bad because this created harmful stress among employees and also compromised the quality of work provided to the public. More than a dozen unions representing employees in private-sector offices and customer service work took such stands. These included the Airline Employees, Communication Workers, Auto Workers (white collar division), Brotherhood of Electrical Workers, United Electrical Workers, Machinists, Newspaper Guild, Office and Professional Employees, Service Employees, Teamsters, Telecommunication Workers, and Typographers. They were joined by such public-sector unions as the Postal Workers and the State, County, and Municipal Workers.[42]

By the end of the 1970s, the "unfair stress" theme had been joined by explicit privacy claims. This was aptly symbolized by the labor-supported Congressional hearings held in 1979 by a House Education and Labor Subcommittee, into "Pressures At The Workplace." A stream of union witnesses denounced industry work monitoring practices at these hearings.[43] Then, as part of the Carter Administration's "privacy initiative," responding to the U.S. Privacy Protection Study Commission's recommendations, the U.S. Department of Labor held hearings in 1979-80 into "Workplace Privacy." Union representatives testified at length about work monitoring practices as improper invasions of privacy. By 1980, the union position on work monitoring included the traditional "intrusive" aspects on close work monitoring, but had added a newer concern which criticized the failure of many managements to let workers see what records were being collected about their work performance. As students of privacy issues are aware, "limiting intrusiveness" and providing data subjects with "right of access" were key elements in the concepts of privacy and fair information practices that had been developed from the National Academy of Science's Databanks in a Free Society Report in 1972; the HEW Report in 1973; the Federal Privacy Act of 1974; and the report of the U.S. Privacy Protection Study Commission in 1977.

Though many unions protested in labor negotiations what they considered unfair uses of telephone-service monitoring, the only clause obtained in a major collective bargaining contract involving office work in this period was one obtained by three major telephone unions in the Bell System contract of 1980. This eliminated "diagnostic remote monitoring" as a management practice, but did not limit the main on-site monitoring of service operators.[44]

Arbitration rulings between 1975-1980 continued the basically "management prerogative" orientation of our baseline era. A series of decisions held that employers could use closed circuit TV cameras to record employees at work, whether as part of time-and-motion studies, to observe productivity, or to police high-risk areas for theft or misconduct.[45] Challenges to telephone service monitoring as a violation of state anti-wiretapping laws were also rejected by arbitrators.[46]

The failure of unions to win such grievances in arbitration, or to get monitoring addressed in collective bargaining led unions such as the CWA, the Teamsters, and others to concentrate in this period on efforts to obtain action by regulatory agencies or legislatures, to which we now turn.

E. Public Forums: Legislatures, Executive Agencies, and the Courts

At the federal level, the Report of the National Wiretapping Commission in 1975 recommended that the issue of employee service monitoring be left to private labor-management relations, thereby leaving intact the legal authority of the telephone company and employers using telephone equipment to engage in such conduct.[47]

The use by Federal agencies of employee service monitoring became the subject of public controversy in several Congressional inquiries in the late 1970s, with newspaper stories documenting such activities by the I.R.S., Social Security Civil Service Commission, Justice Department, and others.[48] The IRS, for example, disclosed that it monitored 325,000 calls a year of some 30 million calls received, to determine whether tax advisors are giving the public "accurate information courteously."[49] A small-print notice on IRS tax-return forms and manuals informed recipients that the IRS might be conducting such monitoring when taxpayers called in to IRS service centers.* In 1978, the General Services Administration issued for comment a proposed regulation that would have barred federal agencies from listening in on such calls, even where advance notice had been given to customers (a la the IRS notice) and to employees. Protests by agencies and some government contractors led the GSA to shelve this proposal,[50] and federal-agency use of monitoring has continued down to the present.

At the state level, several other jurisdictions joined California and Georgia in setting rules and procedures for notifying employees or customers about the use of such monitoring, or requiring employers to register in advance with the state public utility commission before conducting such monitoring.[51] Under such a regulation issued in New Jersey in 1977, 177 employers registered to use employee service monitoring in the first year of the regulation's operation.[52]

In the judicial arena, a Florida Supreme Court decision interpreted that state's wiretap control law to forbid any taping of telephone calls unless all parties gave prior consent. This led employers such as Florida Power Corporation and the St. Petersburg Times to stop tape recording employee calls, for later discussion with employees about service quality and courtesy. Employers in Florida could and did continue to listen in and take notes for service monitoring purposes, as long as they did not make recordings.[53]

F. Summary

In the transition period of 1975-1980, management retained its broad legal right to set levels of satisfactory production for both factory and office employees, and to engage in various forms of visual or machine monitoring to see that employees met standards of quantity and quality.

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* Several federal agencies operating local offices in states regulating employee service monitoring stated that, as federal activities, they did not have to register with state public utility agencies and follow their regulations. See Wall Street Journal, March 12,1974.

Even in unionized settings, very few limitations on employee monitoring were written into contracts, or protected in arbitration of grievances. Only in the area of telephone-service monitoring had there been regulatory intervention in the 1970s. This did not forbid such activity but set rules for "fair" use: advance notice to employees; limited use for training and quality-control instruction; and allowing employees access to notations if used for discipline. And, because the public's conversations were being overheard, a few states required employers engaging in such conduct to register with public utility commissions, and provide directory notification to the public.

This framework developed for telephone monitoring reflected what we saw as a growing concern among leading elites and the general public for greater protection of privacy rights. There was also growing public concern that employers ought to recognize legitimate for individual rights of employees, especially in non-union organizations, with employee privacy among the rights involved.

While this summarizes the legal situation and the social climate, we also documented a growing focus among industrial and office unions on what they saw as the stress-producing and dignity-invading aspects of close employer monitoring. This was especially objected to when it was done by technological means, such as through numerical-machine-tool systems in factories and remote, on-site monitoring of telephone service. By the time that the 1980 attack on patterns of office automation was written by Working Women, Race Against Time, this early critique of how employers were suing new office systems technology featured the stress and invasion of privacy denunciation of VDT monitoring that we quoted in Section D. The scene was set for VDT work monitoring to become one of the central issues of the debate over office automation in the 1980s.

VI. THE OFFICE AUTOMATION ERA, 1981-PRESENT

To begin our analysis, it is helpful to recap a few elements that we developed in our baseline and transition periods.

A. A Recap of Basic Pre-OA Trends

If we look at work settings in the office in the 1960s and 1970s, before the introduction of word processors and micros, an occupational map of performance monitoring of office employees might have been drawn as follows:

Highly-routinized jobs	Semi-routine jobs	Least-routinized jobs
Data and order entry	Secretary	Executive secretary
Customer-service (complaints, telephone orders, reservations, etc.)	Draftsperson	Professional and scientific worker
	Claims adjustor	
Typing pool	Messenger and mail clerk	Salesperson
Financial and inventory clerk	Receptionist	Supervisor and manager
	Programmer	Executive

Workers in the highly-routinized categories generally had quantitative standards set for their performance, and we saw that regular collection of data on their individual output was done in some offices to see that performance continued to meet the standards. This was done on two bases: (1) quantity -- lines typed, orders entered, papers filed, calls taken, etc.; and (2) quality -- errors in typing and data entry, papers misfiled, poor or discourteous handling of customer calls, etc.

Somewhat "looser" production standards were set for office workers in the semi-routine jobs. "Subjective" and "qualitative" factors were usually considered sufficiently important that only periodic quantitative checks were made and these were usually balanced against the qualitative measures.

Among the least-routine jobs, salespersons were usually subjected to rigorous performance measurement, in the form of orders taken, dollar-volumes sold, etc., so that a high-autonomy job could sometimes be one in which individual and regular numerical monitoring took place. For most of the sample occupations listed under our "least-routine work" category, however, individual monitoring did not take place. There, the employee's performance was judged by the output of units or groups that he or she belonged to (scientific and technical workers) or that the employee directed (supervisors, managers, and executives).

This sample of occupational groups also reflects the status, compensation, and power spectrum in organizational offices. The higher the occupational status, the less likely that quantitative standards on an individual basis would be set (with a few exceptions, such as sales), and that regular or even periodic monitoring of individuals would be done by management.

The critical aspects of individual monitoring of highly-routinized jobs in the pre-OA era was that direct, visual supervision was necessarily occasional (supervisors couldn't be everywhere at once); and record-keeping was not total and continuous (whether of sign-in and sign-outs or tracking work-volumes by small units of time, such as hours or even by day). And, where telephone-service monitoring was used, this was a periodic, sampling technique, rather than a continuous oversight.

In terms of social norms and legal controls, measuring work output for highly-routine and semi-routine jobs seemed acceptable to social opinion in the pre-OA era of 1945-1980. Social critics and unions would attack "sweat shop" employers who paid low wages, set high production quotas, and supervised their employees in "exploitive" ways. Judged by objective actions of society -- low unionization of such employees despite heavy union organization efforts; the absence of general regulatory intervention; and non-intervention by the courts under any statutory or constitutional bases — it seems accurate to say that the American public assumed that most office work was being measured and most individuals were being evaluated in ways that did not call for social interventions against existing employer practices.

There were two important types of "monitoring" that were exceptions to this social approval: (1) employer monitoring of telephone calls by employee customer-service operators (for telephone companies, airline reservations, newspaper classified-ad departments, utilities, etc.) and (2) employer use of hidden microphones to record employees at various work locations. In these areas, as we saw, there were some interventions in the pre-OA era -- by statute or regulatory-agency rule, or under a few collective bargaining contracts. We will return to these actions and their relationship to the VDT work monitoring question later in this report. The key point to make here is that there were some forms of employer monitoring of employee on-the-job performance that had already raised privacy issues in the pre-OA office setting, and for which concepts of "reasonable" and "unreasonable" employer surveillance had been formulated.

Throughout the development of the per-OA office, from the early days of mechanization and standardization of office work (1890-1930s) to the 1960-1980 period of electric efficiency and "modern management," there have been not only conflicts between the classic union position ("group" rather than "individual" norms for pay and performance) and that of management, but also a diversity of positions within the management camp itself as to the most effective and justified methods of measuring and rewarding employee performance. These employee-relations issues involve whether to use incentive pay systems for various types of jobs and occupations; how to use time-method-and-motion studies and other quantitative "standard-setting" approaches; what are acceptable and unacceptable techniques of supervisory observation and evaluation; and other similar issues. By the 1970s, the literature on work measurement and evaluation featured many divergent judgments as to the best management approaches in the work environments and employee-value orientations of our era. These ranged from the traditional, Taylor-based belief in scientific time-motion approaches using standards and competitive incentives to calls for more employee-participative and "humanistic" approaches. (See the footnotes for examples of these positions.) These were not privacy based issues, we should note, but matters of employee or labor relations, governed essentially by collective bargaining where office employees were union represented or by marketplace factors and employer-philosophy in the non-union settings.

B. The Social Climate: 1981-1985

Attitudes of the American public and of organizational leaders toward privacy remained basically the same in the early 1980s as they had been recorded in the Sentry survey of 1978. A Louis Harris survey in 1983 sponsored by Southern New England Telephone Company found that concern over invasion of privacy, abuse of computer technology, and failure of public and private organizations to keep the sensitive personal information they collect fully confidential, was still the view of majorities of the public. Also, there was a strong willingness to use law and penal sanctions to punish willful privacy intrusions by organizations using information technology.[54]

Two other important social trends marked the early to middle 1980s. One was a rising medical, media, and public concern about the health effects of stress at the office workplace. Studies showed that stress among office workers was a contributing cause of adverse health impacts such as heart disease, and that clerical workers -- because of their "high demand-low control" working situations, were among the occupations in office work most "at risk."[55] While the studies did not find that harmful stress by clerical workers was dependent on VDT use -- high levels showed up in high-production, closely monitored clerical work with pre-OA technologies -- the growing use of "machine paced" and "machine monitored" VDT clerical work became a major concern of stress research and scientific evaluation.

The second trend was growing public, expert, and media concern over work and workplace issues in the United States. Economic recession, heightened world competition, widespread layoffs, and uncertainties over job and career futures provided the basic dynamic behind this concern. But it was also prompted by concern over the deepening impact of office technology uses on the quality of work life -- on the content and design of jobs, on social relationships in offices, on physical effects of using VDTs in inadequate ergonomic conditions, on health and safety issues raised by VDT use, and on future job opportunities as whole industries moved to convert high-volume data and telephone transactions to VDT processing. While work and its effects on people has always been an important issue in American life, the changing office workplace took on a primary importance in the lives of millions of Americans in the 1980s that it had not had, to that extent, in previous post-World-War II decades.

These social trends help to explain why VDT use, and the work monitoring issue in particular, moved onto the national public agenda in the 1983-1985 period. Specifically, national TV programs such as the McNeil-Lehrer Report[56] and ABC-TV Nightly News[57] featured programs on "Big Brother" monitoring in 1984.* A stream of newspaper and magazine stories in the general press included attacks on "VDT surveillance of workers" in their treatment of the new automated office and the social issues it presented.[58] Business magazines reported on the controversy, again with a strong focus on the work monitoring issue.[59] As union and women's activist group campaigns for VDT legislation unfolded in 15 states in 1982-84, and bills in seven states included bans on work monitoring, the media gave further publicity to the monitoring question.[60]

In this growing discussion of VDT uses, concern over "harmful stress" and violations of "employee dignity and privacy" came together in the critique of "unfair work monitoring." We will return to a more detailed account of the critic's case on those grounds, and of employer responses, in later sections of this report. First, however, we need to examine the nature of VDT monitoring, the extensiveness of its use in clerical work, and the major patterns of employer applications of VDT monitoring capabilities.

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* A transcript of these two television programs is included in the Appendix.

C. Monitoring Capabilities of New OA Technology

What is new about office system technology is that it is now feasible to record and cumulate the inputs of individual VDT operators on an "instantaneous" basis, and to use the software capacities of both stand-alone word processors and multi-terminal office systems to pace and guide operator performance.

- Computer technology can automatically record when operators sign on and off their terminals each work period; how long their transactions take (whether these are telephone calls, orders processed, sales made or claims adjusted); when operators leave their machines; how long the "down time" is between transactions; how many transactions are completed each day; and similar aspects of operator performance.
- Most multi-station terminal systems automatically generate detailed master records of the kind described above for each terminal and for each identified operator at that terminal. This can provide management with a documentary record for each worker by minute, hour, day, week, or month.
- Office systems can be programmed (through commercially available software or by the software designed by user employers) to "prompt" operators with audible or visible cues to keep the pace of work moving. This results in lights flashing on terminal screens or "bulletin boards" when calls are waiting, bells or tones sounding if an operator pauses too long between transactions or is away from the terminals too long, or "alert" signals being sent to supervisor terminals if operators are falling behind production quotas.

On the following pages, we reproduce two printouts that illustrate the individual-operator records that are generated from word processors or data entry machines through software programs. The first sheet, headed "IV Phase," is from the National Finance Center, Office of Finance and Management, of the U.S. Department of Agriculture.[61] It is part of an Operator Statistics System that processes data from a Four Phase mini-computer system used by a Data Preparation Unit. Programming accumulates a daily operator summary and "detail statistics" for "each batch of data entered by the operator." It also generates reports showing individual performance by operator and application, identifying proficiency level under five rankings for each operator. The daily totals are for entry and verify keystrokes, entry and verify time, and total time, calculated in hours, minutes, and seconds. A monthly performance appraisal report is generated averaging the operator's daily times.

```
                                                   IV PHASE
                                              OPERATOR STATISTICS
                                DETAIL LISTING OF BATCHES PROCESSED BY OPERATOR
 DATE PREPARED  10/01/84                         FROM 09/02/84 THRU 09/29/84                                         PAGE     1
 OPERATORS ID:  CHERYL T STEWART                   ENTRY MODE STATISTICS                      VERIFY MODE STATISTICS
  DATE ENTERED:    09/05/84

  JOB    SYS/SCNN DOC                              PROF              TOTAL  HRLY                       TOTAL  HRLY
  NAME     NO.    TYP  BATCH-NO COMPLETED          LEVEL              K/S   RATE  TOTAL TIME            K/S   RATE  TOTAL TIME

 PINEF      05/00 065    Q65021 06:16:40             5               2015  10332 00:11:42               0      0  00:00:00
 PINEF      05/00 060    R60002 06:33:27             5               3212  13168 00:14:38               0      0  00:00:00
 PINEF      05/00 060    Q60240 06:46:17             5               1179  12230 00:05:47               0      0  00:00:00
 PINEF      05/00 060    Q60215 07:05:46             5               2276  10318 00:13:14               0      0  00:00:00
 PINEF      05/00 060    Q60219 07:21:00             5               2557  11184 00:13:43               0      0  00:00:00
 PINELIST   05/00        Q60247 07:28:49             2                701   5923 00:07:06               0      0  00:00:00
 PINEF      05/00 130    Q13056 07:34:49             5                706  14120 00:03:00               0      0  00:00:00
 PINEF      05/00 130    Q13055 07:37:55             5                723  16792 00:02:35               0      0  00:00:00
 PINEF      05/00 190    Q90080 07:38:56             5                 93  17620 00:00:19               0      0  00:00:00
 PINEF      05/00 309    Q38081 07:40:58             5                252  10080 00:01:30               0      0  00:00:00
 PINEF      05/00 115    Q90072 07:42:07             5                195  16712 00:00:42               0      0  00:00:00
 PINEF      05/00 110    Q10071 07:50:40             5               1273   9546 00:08:00               0      0  00:00:00
 PINEF      05/00 095    Q95070 07:56:17             5               1281  15526 00:04:57               0      0  00:00:00
 PINEF      05/00 095    R95001 08:10:52             5                145  16836 00:00:31               0      0  00:00:00
 PINEF      05/00 130    R13001 08:12:06             5                175  13124 00:00:48               0      0  00:00:00
 MISPAY     05/00        U6394  08:23:47             3               1424   8111 00:10:32               0      0  00:00:00
 MISPAY     05/00        U6329  08:25:03             5                189  14790 00:00:46               0      0  00:00:00
 MISPAY     05/00        U6328  08:26:38             5                185  14170 00:00:47               0      0  00:00:00
 MISPAY     05/00        U6393  09:04:15             2               3884   6239 00:37:21               0      0  00:00:00
 ADB38INV   05/00        N2162  09:14:38             5               1910  16768 00:06:50             356  14240  00:01:30
 ADB38INV   05/00        N2161  09:24:15             5               1849  15516 00:07:09             349  12564  00:01:40
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55.

The second printout presented as an illustration is one recording the work of word processors in an Oregon State Government agency who prepared or revised letters and documents for their department. (This was used as evidence in a discipline case that went to arbitration, and will be discussed later in this report.) The printout contains a document number ID; a code for each operator comprised of the unit she works in (ADJ), the type of document (TC - telecommunication, for example); and finally the initials of the operator. The "unit" refers to the specific work station the operator was using. "Activity" indicates the kind of work done on the document. The last column, "Keystrokes," is a cumulative count of all keystrokes made in the course of working on that document.[62]

July 11 through July 22, 1983 Unit 32

	Operator	Unit	Activity	Date	Time In	Time Out	Work Time	Pages	Key Strokes
W	ADJTCJS	32	Creation	07/21/83	10:42	10:43	01	1	58
W	ADJNMJS	32	Creation	07/21/83	10:42	10:44	01	2	9
W	ADJNMJS	32	Creation	07/21/83	10:45	10:46	01	4	15
W	ADJNMJS	32	Creation	07/21/83	10:52	10:56	03	4	215
W	ADJTCJS	32	Creation	07/21/83	10:57	11:00	02	1	185
W	ADJTCJS	32	Creation	07/21/83	11:00	11:02	01	1	339
N	ADJOLJS	32	Edit	07/21/83	11:06	11:06	01	2	578
J		32	Edit	07/21/83	11:06	11:07	01	10	310154
W	TCB816	32	Creation	07/21/83	11:07	11:08	01	3	2
		32	Edit	07/21/83	11:09	11:11	02	26	41154
		32	Edit	07/21/83	11:12	11:14	02	42	74096
		32	Creation	07/21/83	11:15	11:17	02	26	8835
		32	Creation	07/21/83	11:18	11:19	01	69	30650
W	TCB819	32	Creation	07/21/83	11:19	11:20	01	3	2
V	TCB818	32	Creation	07/21/83	11:21	11:21	01	3	6
W	ADJNMJS	32	Creation	07/21/83	11:21	11:25	03	22	39
N	ADJMAJS	32	Edit	07/21/83	11:24	11:25	01	14	3846
J		32	Edit	07/21/83	11:24	11:26	3 wds 01	10	397006
W	ADJNMJS	32	Creation	07/21/83	11:25	11:47	21	22	2957
N	ADJMAJS	32	Edit	07/21/83	11:57	12:00	02	11	1642
J		32	Edit	07/21/83	12:00	12:00	01	10	397205
W	ADJTCCW	32	Creation	07/21/83	13:00	13:00	01	1	159
W	ADJNMJS	32	Creation	07/21/83	13:00	13:01	01	6	2234
J		32	Edit	07/21/83	13:00	13:01	01	10	310253
J		32	Edit	07/21/83	13:01	13:02	01	10	310278
W	ADJNMJS	32	Creation	07/21/83	13:03	13:13	10	23	4295
W	ADJNMJS	32	Creation	07/21/83	13:13	13:26	12	23	4566
W	ADJNMJS	32	Creation	07/21/83	13:27	13:31	04	23	4652
J		32	Edit	07/21/83	13:31	13:32	01	10	310351
W	ADJMEMOJS	32	Creation	07/21/83	13:39	13:44	05	3	375
J		32	Edit	07/21/83	13:45	13:45	01	10	397656
W	ADJTCJS	32	Creation	07/21/83	13:45	13:49	03	1	246
W	ADJNMJS	32	Creation	07/21/83	13:57	13:59	01	17	19
W	ADJNMJS	32	Edit	07/21/83	14:00	14:01	01	6	2356
J		32	Edit	07/21/83	14:01	14:02	01	10	397871
W	ADJNMJS	32	Creation	07/21/83	14:01	14:16	14	14	336
J		32	Edit	07/21/83	14:15	14:16	01	10	398091
W	ADJTCJS	32	Creation	07/21/83	14:16	14:17	01	1	26
W	ADJNMJS	32	Edit	07/21/83	14:21	14:23	01	16	375
W	ADJNMJS	32	Edit	07/21/83	14:24	14:29	04	4	434
J		32	Edit	07/21/83	14:28	14:30	01	10	398419
W	ADJNMJS	32	Creation	07/21/83	14:30	14:32	02	2	175
J		32	Edit	07/21/83	14:33	14:33	01	10	398446
N	ADJTCJS	32	Creation	07/21/83	14:33	14:37	03	1	252
W	ADJTCJS	32	Creation	07/21/83	14:39	14:39	01	1	28
W	TCB833	32	Creation	07/21/83	14:39	14:40	01	2	2
W	TCB834	32	Creation	07/21/83	14:39	14:41	01	3	2
W	ADJNMJS	32	Creation	07/21/83	14:40	14:41	01	2	180
W	ADJTCJS	32	Creation	07/21/83	14:42	14:43	01	1	2
W	ADJTCJS	32	Creation	07/21/83	14:42	14:43	01	1	24

D. Employer Incentives To Use VDT Monitoring Capabilities

The 1981-84 period was one in which a combination of external and internal factors invited managements moving into OA to consider applying the monitoring capabilities of office systems technology to intensive VDT production work. The recession meant that producing products and services at greatly reduced costs, and reducing "headcount" were management imperatives. Setting ambitious production quotas for data entry, claims processing, word processing, and customer-service operations and "policing" these through detailed operator performance records seemed a major way to cope with recession pressures. Government agencies facing budget slashes had similar incentives.

At the same time, deregulation meant that many businesses had to lower costs drastically to compete both with lean, young entrants in their own industries and large, powerful firms from other industries who were now "raiding" their preserves. Established airlines, for example, had to cut reservation processing costs to meet the competition of new, low-salary and non-union air carriers. Local banks now had to compete with out-of-state banking institutions, while banks, insurance companies, brokerage houses, and large retail chains were now in sharp competition for the public's investment dollar. Competition from foreign firms added a final challenge to some firms, though this was not as common in office work as in industrial settings. In our site visits, we found that pressure to lower information processing costs because of all these "new competitive pressures" was the most common reason given for applying production quotas and monitoring to intensive VDT work. This was especially true as we will discuss in a later section, of AT&T in the period of the late 1970s, and especially from 1980-1983.

Finally, organizations that spent large sums of money on terminals and office systems generally did so because the vendors promised extensive improvements in productivity, and advocates of OA expenditures inside the organization had set out detailed plans documenting how such productivity gains would be achieved. Given the reality that changeovers to new OA systems almost invariably meant disruption of routines and working group rhythms, and that frequent downtime of OA systems was common, there was a built-in "upset" factor in the first stages (often months to years) in most large OA applications. In many sites we visited, this led to pressures on group or division or bureau managements to "get production up," and that pressure was passed on directly to unit managers, who passed it right along to supervisory staffs. With their own performance ratings, bonuses, promotions, and careers riding on "payoff performance" from the new OA equipment, supervisors leaned on clerical workers doing the most intensive VDT work to produce more, faster.

Since many organizations already used production quotas and work monitoring in the pre-OA era, these had little trouble in applying their basic philosophy with the newly-enlarged capacities of VDT systems. Some firms we visited that had not used work monitoring in the pre-OA period adopted this practice in their OA clerical operations, both for "competitive pressure" and "new opportunity" reasons. At the same time, most organizations we visited which had a personnel philosophy that did not accept production quotas and work monitoring in the pre-OA era did not abandon that approach just because they plugged in word processors or telecommunication terminals for customer service work. (We will give examples of these policies later.)

E. How Extensively is VDT Work Monitoring Being Used?

There are no trustworthy figures on how extensively employers are applying VDT based software to monitor individual operator performance and use this to make individual judgments on pay, promotion, or discipline. No one has such figures, and no available basis for calculating them is at hand. When we read a recent magazine article that quoted NIOSH as having estimated that the two-thirds of 7 million employees using VDTs in the U.S. are being "electronically monitored" by their employers,[63] we contacted Dr. Smith about the report. He stated that he had never made such a statement and that he knew of no NIOSH study or report that had ever made such an estimate. His opinion is that no-one has reliable figures on the extensiveness of individual VDT evaluative monitoring.[64]

What we can provide to OTA is a series of empirical observations we have made or collected on particular subsets of the employee population, and, from these, suggest some ball park figures as to how widely VDT monitoring may be going on overall.

1. Our VDT Site Visits, 1982-84

At the particular locations we visited at 110 business, government, and non-profit organizations, the following describes how VDT monitoring capacities were being used:

- The great majority, in the 80-90% range, were collecting some operator statistics for at least some of their clerical workers, using the most production-oriented segment of their VDT work. Those not collecting statistics at all were usually organizations using older word processing or micros that did not have software for extensive monitoring; organizations with new applications in early implementation; non-profit organizations (especially universities) who "just don't do that;" and some state and local government agencies which "saw no need to compile those records."

- Of those collecting individual statistics, about a quarter said they used these only for assessing group performance, to plan for handling peaks and valleys of work demand, and to cost-justify their use of the office systems.
- The remaining three-quarters are using individual operator statistics to make some sort of individual-operator evaluation. This ranged from "we use it to spot the need for more training" to those who based standard pay, incentive pay, or promotion on the machine records, with some saying it was "almost the entire basis" for such judgments and others saying it was "one factor in five or six factors used to evaluate performance."

2. Use By Banks

In the Fall of 1984, we conducted a survey of VDT uses and policies in office automation among banks. Questionnaires were completed by personnel officials of 133 banks and other financial-services organizations.*

Unlike the focus on very large banks that often marks the discussion of VDT uses, the distribution of these respondents included substantial numbers of smaller and medium-sized institutions, which predominate among the nation's 15,000 banks and for whom most bank employees work.

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* Respondents were bank personnel officials attending the American Bankers Association annual Human Resources Conference in 1984, and subscribers to Bank Personnel News.

Number of Employees	Percent
Under 200	58%
200-500	22%
500-1,000	11%
Over 1,000	9%

The respondents were also well distributed by geographic region.

Region	Percent
Midwest	35%
Northeast	22%
Southwest	20%
West Coast	12%
Southwest	11%

In terms of the number of VDTs that these banks have installed in 1984:

- 40% report having under 50 VDTs;
- 26% report having between 50-100;
- 12% report having between 100-500;
- 22% report having over 500

The penetration of terminals for various occupations in these banks follows the pattern of generally known trends: heavy for customer-service operators, tellers, and data entry workers; moderate in professional and lower management positions; and lightest among executives. Respondents estimated the percentage of VDT use among various occupational groups as follows:

Occupational Group	Percent of Work Group Using VDTs			
	1-25%	26-50%	51-75%	76-100%
Data entry operators	5%	6%	27%	62%
Tellers	16	13	12	59
Customer-service operators	14	13	8	65
Professional and technical	21	24	24	31
Supervisors & middle managers	40	25	15	20
Executives	54	20	14	12

Respondents were then asked if their bank sets "individual operator standards for VDT output (keystrokes, transactions completed) for any of the following jobs?" About a third say they are doing so for data entry work. Under one in five banks report that they are doing this for customer-service and word processing jobs.

Type of job	Percent setting individual standards
Data entry	36%
Customer-service	19%
Word processing	17%

Looking at VDT individual work monitoring in terms of bank size, use of this technique for clerical work was reported by some banks in each size category. Of the 36% of respondent banks (48) reporting they did work monitoring for data entry workers, 31% had under 200 employees; 36% had 200-500 employees; 18% had 500-1,000 employees; and 15% had over 1,000 employees. However, looking at the reported-use percentages within each bank workforce size category among our respondents indicates that monitoring is most frequently done in the larger banks and least often by the smaller ones; about three quarters of the banks with over 500 employees said they did use this technique, and about three quarters of those with under 200 said they did not do this. (Since ours was not a representative sample of banks by size, and did not produce enough responses in the larger-bank category to support projections as to large-bank policies, these figures should be read as suggestive only. They do parallel other data available as to relation between size of the organizational clerical work unit and use of individual work monitoring.)

In setting work standards for VDT operators, operational managers in banks seem to be making these decisions rather than human resources divisions. Sixty-eight percent of these personnel officials reported that the human resources function was "not involved in work standards," 18% said human resources was "slightly involved," and 10% said it "shared authority" on VDT work standards with another function in the bank. Only 2% said that human resources was the "primary function" that determined what the work standards would be for VDT operators. (66% of respondents also said that human resources was not involved in "design of VDT job content.")

Discussions that we had with bank personnel officials who had filled out the survey at the American Bankers Association Conference indicated that the reasons why majorities of these banks are not setting individual operator standards for these three types of clerical jobs -- and why we were told they did not do machine-monitoring -- paralleled what we were told on our site visits.

- Collecting statistics by work group serves productivity needs well enough;
- Supervisors are able to judge employee performance satisfactorily without the need for continuous monitoring of individuals;
- The quality of work (achieving low error rates, servicing customer satisfaction, selling new bank services, etc.) would not be served well by what one personnel executive called a "production statistics approach."

3. Data From A Survey Of Security Officers In 301 Business And Government Organizations

In November of 1984, we distributed a questionnaire to attendess at the 11th annual Computer Security Conference. From approximately 1,000 participants at the conference, we obtained 301 completed returns, for a response rate of about 30%. Respondents were primarily security officers (58%) and DP managers (18%), with others coming from planning, auditing, and operational management. The organizations these respondents work for are primarily private-sector businesses (67%); 23% were government agencies and 8% nonprofit organizations. Most work in medium to large sized organizations. 68% report their organizations have over 1,000 employees, and 32% under 1,000 employees. (Since 22% of all respondents said they were reporting for subunits of larger organizations, there are probably more large organizations being represented than the raw figures indicate.)

In terms of VDTs in place, 48% report they have under 500 terminals and 52% over 500 VDTs. In terms of clerical level OA occupations, respondents reported that the following percentage of each occupational group has a VDT or shares one for regular work:

Group	0-25%	26-50%	51-75%	76-100%
Data entry operators	14%	9%	10%	63%
Customer-service personnel	21	14	7	43
Secretaries	19	20	16	44

When asked to describe their status as a user of office automation -- in terms of "mainstream" versus "advanced" technology use -- 54% of respondents rated themselves as "highly advanced" or "advanced in some areas" in using OA. (More rated themselves as highly advanced in EDP and Telecommunications uses.)

One question on the survey asked respondents: "Does your organization use any monitoring of individual operator keystrokes or transaction volumes to determine pay, bonuses, performance evaluation or promotions?" Because of the desire to keep this survey as short as possible to increase responses, we designed this question so that only those who both monitored individuals and used this to determine employee rewards would reply affirmatively.

- Twenty percent of respondents say that such monitoring is used in their organizations. These were the larger organizations among the total respondents (85% had over 1,000 employees).

In terms of their self-descriptions as advanced or mainstream users of OA, 23% said they were in the mainstream; 33% said they were advanced in some applications; 25% said they were highly advanced; and 19% said they were behind the OA mainstream, overall.

In other questions we asked about work monitoring:

- Fifteen percent of the respondents said their organization had "a formal policy on how individual work monitoring should be conducted."
- Ten percent of the organizations doing such monitoring said that some of their employees had "raised concerns about this as 'Big Brother' monitoring."

4. 9 to 5 VDT Hotline Callers

9 to 5, the National Association of Working Women, initiated a "Campaign on VDT Risks" in May of 1983, which included a nationally advertised "Hotline" that VDT operators were invited to call to discuss their experiences. Within six months, 6,000 calls had been received, two-thirds (about 4,000) from VDT users. (The rest were from supervisors, employers, and others.) Of 6,000 questionnaires sent to Hotline callers, 873 were returned, and these were analyzed by the 9 to 5 organization. They point out that this is not a representative sample of office workers in general or VDT users in particular, but is "instructive in pinpointing the typical uses and effects of VDTs among a wide variety of users."[65]

Sixty-two percent of the Hotline respondents were clerical or secretarial workers. (The rest were professionals, supervisors, managers, or others.)

79% have worked with VDTs over a year and now do so over 4 hours a day.

Only 11% of the total respondents say the speed of their work is controlled "mainly by computer." (65% say they control their own work; 10.5% mainly by the supervisor; and 16% by "both supervisor and computer." 35% say their work is "measured by the computer," while 54% say it is not, and 11% don't know if it is).

Only 28% say they have a "required amount of work to produce." 72% say they do not. Of the 28% that have work quotas, 91% say they receive extra pay or incentives when they produce more than that amount. Only 5% say they lose pay when they fail to produce their quota.

5. 9 to 5 National Survey on Women and Stress

A national survey on women and stress was conducted by 9 to 5 in late 1983. Respondents were 40,000 readers of four major women's magazines -- Working Woman, Ms., Glamour, and Essense (the latter a primarily black readership audience).[66] While these magazines have generally middle class readerships, the occupational roles of the total respondents and the subsample created for analysis provide a group of office workers whose responses are worth noting. It was clearly not a representative sample (being reader-volunteers) and it almost certainly underrepresented lowest-level data-entry workers, part-time and temporary clericals, and lower-paid black, Hispanic, and oriental women.

Forty-three percent of the 4,500 responses selected for analysis reported that they were using VDTs, CRTs, word processors, or PCs. Of these users, 25% were in managerial jobs, 30% were professional and technical workers, and 44% were in "clerical" posts. The survey combined secretarial, customer-service, data-entry, and other similar functions to make up its "clerical" category.

One question on the survey asked: "Is your work measured, monitored, "constantly watched" or "controlled" by machine or computer system?" 17% of all OA users, about one in six respondents, said yes and 83% said no. Of "clericals," 20% (one in five) said yes and 80% no. (15% of "managers" and 13% of "professionals and technicals" also say their work is monitored or measured by machine.)[67]

In terms of intensity of use, two out of five of the total OA users were using their machines 50% or more of their time per week, with clericals the largest users, professionals next, and managers the least.

6. Overall Estimate

Looking over these very diverse surveys and field observations, and recognizing their limitations, we believe two overall inferences can be drawn, as a backdrop for this report:

- The great majority of clerical employees working on VDTs -- in the 65-80% range -- are not presently monitored by machine and evaluated for pay, promotion, or discipline on that basis. Assumptions that most employers using VDTs are monitoring most of their clerical workers are not warranted.
- However, if 20-35% of clerical employees using VDTs are being monitored, this means several million employees are being evaluated in this manner. This is a substantial population of workers, and a number that could grow steadily larger in the next 5-10 years. Therefore, social attention to how VDT monitoring is being carried out among clerical workers is certainly warranted.

F. Factors Explaining Differences in Managing VDT Clerical Work

As we noted in summarizing use levels from our site visits, a majority of organizations are collecting individual operator statistics for some of their clerical applications. Organizations then divide into three camps: those that use these only for group evaluation, planning, and cost-justification analyses; those that apply traditional, supervisor-driven performance monitoring; and those that have developed "fair performance measurement" approaches. We turn in this section to a discussion of factors that explain these variations.

As was true in the pre-OA era, and we will see to have continued in early use of office systems technology, organizations have not faced many external constraints thus far in their decisions whether to use or not use VDT work monitoring. There are no federal or state laws or common law judicial decisions governing employer use of evaluative monitoring, apart from the advance notice and record-access rules set by some state public utility commissions for telephone/telecommunication service monitoring. Under both government and private labor relations law, and arbitrator rulings, the decision to adopt and use individual work monitoring is a "management right," not required to be bargained for in unionized settings. Grievance appeals place few limitations on unionized managements either, unless the monitoring is used to conduct surveillance on union organizers or officials. As for executive-level rules for government agencies, through civil service or personnel regulations, we found no municipal, state, or federal limitations against conducting individual work monitoring.

Recognizing that non-telephone VDT jobs are not affected by external legal or regulatory constraints, what explains the variations among employer organizations that we have described?

Based on our site visits, and other materials collected for this report, we believe that variations among organizations arise from the following factors:

- First and foremost is management philosophy. Within the same industries and among similar government agencies, adoption of work monitoring and variations in how this is used flow primarily from top mangement's approach to personnel administration and operational style. We found organizations with virtually identical clerical operations and OA applications that did and did not use individual work monitoring, or used it in significantly different ways. Put another way, how managements approach motivating and rewarding employees, including clerical employees, is a critical element in how OA technology will be used by that organization.
- Second is the nature of the work being done and its perceived role in the operations of the organizationa. The more "routine" the clerical function is perceived by management to be, and the

more decisive its costs are seen as being to the profitability of the business or service-delivery in government, the more likely it will be that work monitoring will be used. In many organizations, therefore, work monitoring is used only for those operations and not for other clerical applications of OA, and not for secretarial, professional, technical, and management work.

- Third is the nature of the organization's operations. The more a clerical function is a vital part of an organization's central business -- customer service in airlines, utilities, telephone companies, hotels, credit-card firms, insurance claims processing, and comparable functions in government tax, licensing, social services, and law enforcement agencies -- the more likely it is that most organizations in this situation will set formal work standards, monitor individual performance, and use this for personnel administration. Where a clerical function is not central, but is more of a general administrative support function in offices, monitoring can be regarded as not "necessary" for such operations by this organization.
- Fourth is the specific approach being taken by each organization toward OA technology as an instrument and a process. There are some managements that believe the adopting OA for routine clerical work "dictates" individual monitoring, partly because capital costs must be recovered by greater productivity and partly because the presence of a technological capability -- generation of individual records on a continuous basis -- represents an enhancement of management supervision and worker control that it would be "foolish"

to reject. Other managements believe that such uses would violate their organizational culture and decline to accept a technological imperative.

- Fifth, is the perceived employee response. If managements assume that clerical employees do not mind and can live with close individual monitoring (and those that mind can easily be replaced); if the quality of work does not seem to suffer unfuly; and if no employee subotage on the job is likely, then such managements may see "all plus" and "no minus" in using monitoring.
- Sixth is the quality of labor-management relations in union-represented organizations. Some managements do not use evaluative work monitoring because they say they do not want to risk conflict with local and national union officials by doing this. In other cases, how monitoring will be conducted is affected by either adversarial labor relations (as in the telephone industry) or by cooperative relationships (as in several federal agencies discussed later). Furthermore, some non-union companies we visited said a major factor in their decision to reject operating-management proposals to do work monitoring was a belief that this could "give union organizers a good issue."
- Seventh, the financial condition and resources of the organization bear on the decision. Though all organizations today face budget constraints and pressures to work more efficiently with limited resources, some organizations are much better equipped with revenues and skilled staffs than others, and some organizations skate on the thin ice of survival as their basic condition. In those pressured organizations using close work monitoring will be seen as "not an open question."

- Eighth is the public milieu. Some business organizations are significantly concerned with their public reputation as enlightened and "progressive" employers. They believe this helps them recruit the best new employees and attract customers, and helps the organization in its relations with regulators, public policy makers, and the media. Anything that is likely to give the organization a "sweat-shop" or "Big Brother" image is looked at very carefully by such image-conscious firms, especially if strategic activist groups and trends in media attention highlight the potential "negative exposures" from such conduct.

What this list suggests is that whether organizations do or do not use work monitoring, at all or for a given clerical function, is dependent today on a combination of management-philosophy and situational factors. In the early stages of OA adoption (1976-1982), the external environment for deciding to use work monitoring was almost wholly permissive. However, as we will see, recent changes in the external environment and in the concerns and attitudes of clerical employees within organizations may be altering the milieu within which organizations are operating, and may affect decisions as to work monitoring in the future.

G. Work Monitoring In The Federal Executive Branch

1. Sources for this Discussion

As noted in Section II, we included federal executive agencies (both civilian and military) among our VDT-project site visits in 1982-1984. Seven agencies were visited, with sub-units visited within some of these. In addition, we addressed a letter of inquiry to 78 federal agencies, bureaus, or departments in September of 1984, using a list of ADP executives in these agencies supplied to us by OTA. One area we asked about was whether the agency had any policies or procedures relating to the measurement of work performance by individual VDT/CRT operators. As of December 31, 1984, 44 agencies had responded by letter and accompanying documentation. We conducted follow-up telephone interviews with 12 of these reporting significant activity relating to work monitoring. The list of 44 responding agencies appears in Figure 1.

Figure 1. FEDERAL AGENCY RESPONSES TO PROJECT LETTER ON VDT WORK MONITORING (44)

Adv. Comm. on Historic Preservation
American Battle Monuments Commission
Bureau of Labor Statistics
Commission for Purchase from the Blind
Commission on Fine Arts
Commodity Futures Trading Commission
Department of Agriculture
Department of the Army
Department of Commerce
Department of Defense
Department of Energy
Department of Health and Human Services
Department of Housing and Urban Development
Department of the Interior
Department of Justice
Department of Labor
Department of Transportation
Department of Treasury
Environment Protection Agency
Equal Employment Opportunity Commission (EEOC)
Executive Office of President
Farm Credit Administration
Federal Communications Commission
Federal Deposit Insurance Corp.
Federal Energy Regulatory Commission
Federal Reserve Board
Foreign Claims Settlement Commission
General Services Administration
National Aeronautics and Space Administration (NASA)
National Bureau of Standards
National Capitol Planning Commission
National Commission on Libraries and Information Service
National Endowment for the Arts
National Science Foundation
National Transportation Safety Board
Office of Personnel Management
Panama Canal Commission
Railroad Retirement Board
Selective Service System
Small Business Administration
Tennessee Valley Authority (TVA)
U.S. Information Agency
U.S. Merit Systems Protection Board
Veterans Administration

We also conducted interviews with staffs at the national headquarters and in some local areas for labor unions representing federal employees. These included: American Federation of Government Employees; National Association of Government Employees; National Federation of Federal Employees; National Treasury Employees Union; and American Postal Workers Union.

2. The Federal Government as an OA User

A useful point to discuss at the outset is the position of the federal executive branch as an OA user, compared to the corporate and non-profit sectors. An often asserted judgment is that the corporate sector is, on the whole, "ahead of" the federal executive branch in installing OA. While this may be true if one uses measures such as percentage of word processors per secretary across the federal system compared to Fortune 500 business firms, we do not believe it is correct in terms of pursuing advanced applications. From our site visits to 110 private and public sector organizations, the responses to our inquiry into OA activities at federal agencies, and other sources, we think the situation is more complex than this assertion captures:

(1) Some federal agencies are significantly behind their counterparts in the private sector in both percentage of occupational groups with OA equipment and in advanced applications. Such was the judgment, for example expressed to us by the Federal Reserve Board, in comparing its OA work with leading banks and financial institutions.

(2) Some federal agencies, or units within them, are clearly at the frontier in automating units such as customer-service or in specific OA applications. Examples are the IRS, several military agencies, the Executive Office of the President, and 8-10 other federal organizations.

(3) Many other federal agencies are in a "mainstream" of OA use by both penetration of machines and types of uses that compares closely to the mainstream of most industries, in which it is only a minority of firms that are doing the advanced OA work featured in the media or computer periodicals.

In short, we think it is a mistake to place the federal executive branch as a whole "behind" any other sector of the organizational community in the United States. There are advanced applications being pursued in many federal agencies, plus a drive for integration of information activities through Information Resource Management approaches, that is quite comparable to leading-edge activities in the corporate sector, and is probably ahead of most areas of the non-profit world.

3. The Overall Labor Relations and Personnel Policies Setting in Federal Agencies

Federal labor law doctrines hold that applying work measurements and using these to evaluate employees are management prerogatives, not policies required to be negotiated with unions representing federal employees. This falls under the "Management Rights" clause of the Civil Service Reform Act of 1978. (*Federal Code*, Title V, Section 7106(a) (A) and (B). However, managements at the agency or local level *can*, if they wish, bring the union into the work standards and measurements process. Federal union officials we interviewed stated that attempts had been made to raise the monitoring issue at some federal agencies that have heavy, all-day VDT work and use individual monitoring policies, but these had been rebuffed as "non-negotiable" under the "management rights" clause. Arbitration rulings have upheld agency managements when work monitoring has been challenged, for example, in the Social Security Administration.[68]

Federal unions have adopted bargaining guidelines or model contract provisions on VDTs which they distribute to local bargaining committees or use in agency-wide negotiations.* Despite the "management rights" situation, these union guidelines address work monitoring. The American Federation of Government Employees includes in its current list of VDT contract demands, under "Introduction of Technological Change," the demand that there be "No Monitoring: There will be no machine pacing. There will be no machine monitoring on an individual basis."[69] The National Association of Government Workers includes opposition to monitoring in a list of "VDT protections" it recommends for federal agencies as "health and safety measures," to be used "while research is conducted and long-term solutions are developed" to VDT effects. Their position is that "Stress-inducing features of automated jobs such as machine pacing or computer monitoring should be eliminated."[70]

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* Our main discussion and analysis of union positions will appear later in this report.

While no contracts that we have heard of have adopted such provisions, unions report that they are raising the monitoring issue in joint labor-management committees on health and safety; as part of filing worker compensation claims for employees experiencing harmful effects from intensive VDT use; and in grievances focused on unfair working conditions. And, several unions said they would try to raise the work monitoring issue directly in new contract negotiations in 1985-86, though it would take a "creative approach" to get by the "management rights" clause.[71]

In terms of executive-branch regulations, there are no central rules set for work monitoring by federal agencies by the Office of Personnel Management or General Services Administration, nor is there any presidential executive order governing employee work monitoring. Each agency is free to adopt work measurement and performance evaluation policies for VDT operators as they wish, as long as these do not violate overall federal personnel policies.[72]

4. Monitoring of VDT Telephone Work

As we indicated in our pre-OA baseline account, a distinction has to be made in our privacy-oriented analysis between telephone-based VDT work by customer service operators, where conversations with the public are involved, and situations where employees are handling manual or digital data by VDT. As far as telephone-monitoring is concerned, interviews we conducted with General Services Administration officials in December of 1984 indicated that GSA "still has under consideration" the issuance of the same proposed regulation for telephone-service monitoring by federal agencies that we reported it was "considering" in 1978.[73] "Work is still being done on what rules and guidelines to issue," we were told, with four possible rules presently under consideration:

(1) Agencies would have to publish their rules and procedures for doing service monitoring of telephone-VDT systems.

(2) A log of uses made of service monitoring would have to be kept.

(3) A proper notification of the public would be required.

(4) Approval of GSA would be required.

Service monitoring of VDT-based public or client telephone calls is widespread in 1985 by the same agencies that we reported doing this in 1978. For example, the attached sheet indicates how IRS notifies taxpayers that service monitoring is taking place:

Department of the Treasury
Internal Revenue Service
HOLTSVILLE, NY 00501

If you have any questions refer to this information:

Date of This Notice: AUG. 13, 1984
Social Security Number:
Document Locator Number:
Form: 1040 Tax Year Ended: DEC. 31, 1983

Call: 732-0100 BRONX, MNHTN., ST. ISLD.
997-1510 ROCKLAND COUNTY
or 997-1510 WESTCHESTER COUNTY
Write: Chief, Taxpayer Assistance Section
Internal Revenue Service Center
HOLTSVILLE, NY 00501

If you write, be sure to attach this notice. Include your telephone number and the best time to call.

AMENDED RETURN ACKNOWLEDGMENT

WE RECEIVED YOUR AMENDED RETURN FOR THE TAX YEAR INDICATED ABOVE.

WE WILL REVIEW YOUR RETURN AS SOON AS POSSIBLE. SINCE WE HAVE A LARGE NUMBER OF SIMILAR REQUESTS, IT MAY TAKE AS LONG AS 3 MONTHS BEFORE YOURS IS PROCESSED. WE APOLOGIZE FOR ANY INCONVENIENCE THIS DELAY MAY CAUSE YOU.

YOU WILL RECEIVE A NOTICE FROM US REGARDING THIS TAX YEAR WHEN THE CHANGE HAS BEEN COMPLETED.

IF YOU HAVE ANY QUESTIONS, YOU MAY CALL OR WRITE US -- SEE THE INFORMATION IN THE UPPER RIGHT CORNER. TO MAKE SURE THAT IRS EMPLOYEES GIVE COURTEOUS RESPONSES AND CORRECT INFORMATION TO TAXPAYERS, A SECOND IRS EMPLOYEE SOMETIMES LISTENS IN ON TELEPHONE CALLS.

In some federal agencies we visited, telephone monitoring is done for "checking courtesy" and "correctness of procedures" but not to measure compliance with production standards. For example, the Department of Transportation has a large, nationwide "hotline" service for members of the public to call to ask whether their automobile has been recalled for correction of defects, and other types of automotive information.[74] An official at DOT noted that employees are told that supervisors listen in for courtesy and correct-procedure checks, and employees know this is part of the employee's performance evaluation. However, speed and quantity of calls are not monitored. The official explained:

> "We have not set specific performance standards for operators in terms of how quickly they should get information out to callers -- like 45 seconds. Partly, this is because we know we have peaks and valleys of use, and it isn't easy to standardize parameters. But partly this is because the Carter and Reagan Administrations have not wanted to treat this citizen service like a private business, and feel it is important to let the operator talk with the caller for any reasonable amount of time to handle the problem."

Overall, in our site visits, our federal-agency telephone interviews, and our federal-union contacts, we did not hear of either union complaints or employee discontent over close and stress-inducing VDT-based telephone-service monitoring. Certainly, nothing was raised resembling the protest by the Communication Workers against "stress-inducing" monitoring of directory operators by the Bell System in the 1970s and early 80s. It is the data entry and claims processing functions in some federal agencies that have been the focus of employee and union protest, to which we now turn.

5. Varieties of Federal-Agency Monitoring Practices in Data Processing

As we noted for all employment sectors in our previous section, whether individual operator monitoring will be done vary even within one industry or governmental sector according to the type of VDT job, the role it plays in the agency, the personnel philosophy of the organization's management, the state of labor-management relations, and similar factors. Our site visits demonstrated this varied pattern among federal agencies.

a. Some Agencies Collect No Statistics At All For Clerical VDT Operators

Some federal agencies, usually the smaller ones without heavy data entry or customer-service operations, state that they collect no production statistics at all for clericals using VDTs.[75] The Federal Communications Commission, for example, explains:

> Since we are basically a small agency, we have not attempted formal studies for measuring work performance by terminal operators. Evaluation of all our employees is primarily based on the ability of all staff elements to meet specific agency objectives as defined by management.

Other agencies, just moving into OA applications, indicated they did not plan to install individual monitoring. The information management officer at the National Endowment for the Arts commented.[76]

> There is something particularly Orwellian about automated data-gathering techniques which are initiated, perhaps even with good intentions, to assess an employee's 'productivity' and end -- quite easily -- by monitoring the employee's daily comings and goings. I'm even more concerned about the inevitable next step (backward): the possibility of paying employees -- especially non-union employees, and most especially lower-graded minority and female employees -- by the piece. This smacks too much of a return to a situation the social ramifications of which began to ebb only at the turn of this century.

In other cases, we were told that work monitoring was not done for clerical VDT operations at particular offices or sub-units of agencies we contacted. The Office of Computer Sciences at the Small Business Administration, for example, stated that "policies and procedures designed specifically for evaluating and measuring work performance of individual Video Display Tube/Cathode Ray Tube operators are not the methods of performance measurement currently used by this office."[77]

Most agencies indicated that they had no agency or department wide policy on VDT work monitoring, but left this to local-unit option. As the Department of Labor put this: "Individual organizational units or managers may use such measurements for evaluating performance. As we work to improve productivity, quantified measurements of all sorts are examined for possible use."[78]

b. Some Agencies Collect Statistics But Do Not Use These For Individual Evaluation

Some federal agencies collect production statistics by individual operator but do not use this for calculating individual operator payment or performance. At the Federal Reserve Board, individual operator keystrokes and error rates are collected from employees in data entry, but this is used only for documenting service charges to be paid by divisions using the data entry services. "It is not linked to operator payment," the agency reports. "Our focus for performance is on achieving a standard adequate work unit, with proper quality, and we feel no need to use individual operator statistics to accomplish that." [79]

c. Some Agencies Use Individual Evaluative Monitoring and Report Good Employee Response

A good example of the collection of individual statistics and use for personnel evaluation comes from the Department of Agriculture's National Finance Center data entry unit, whose printouts of operator keystrokes and time we used as an illustration in Section VIB. In a report on how these statistics are used, the Department stated: [80]

> The Data Preparation Unit works primarily on a self-evaluating program for two critical elements: 1. Type Data Entry and 2. Time on the CRT Machine. In addition, there are two noncritical elements operators are rated on. This reporting system affects the pay of each individual operator. The operators must maintain an Acceptable level (3) or above for a 12-month rating period to be eligible for a Within Grade Increase (WGI). Anything below a 3, the WGI is withheld until the operator can satisfactorily meet and maintain the 3 level.
>
> The same principle applies for any operator recommended for a Quality Step Increase (QSI). The operator must maintain an Exceeds Acceptable (4) or better and have an overall performance average of 4.3 or better during a 12-month rating period. No element can be below a 3.

> In summary, the PRSM system has been used in the Data Preparation Unit for 5 years. Supervisors and operators are satisfied with the system. Productivity has increased along with employee morale, because the individual has the opportunity to review their performance in relation to their standards on a monthly basis.
>
> A PRSM report is produced monthly for each operator. Immediate supervisors review the reports with the employees and prepare a monthly performance report for the Section Supervisor. The performance report consists of all four elements the employee is rated on. This determines the employee's performance rating when due. By doing a monthly review, the employee knows what level they are performing and what can be expected on their yearly performance appraisal.

At many of the agencies we surveyed, officials stated that individual work standards were negotiated between the supervisor and the individual employee as part of the regular setting of performance goals for each employee, under Office of Personnel Management guidelines. For example, the U.S. Information Agency reported that their "employee evaluation process requires the setting of individual performance goals each year," and this is done "jointly by the supervisor and employee." They "consist of performance standards appropriate to each job," and, in the case of VDT work, "could include volume or volume and quality measures of VDT/CRT production."[81]

Some federal agencies report that their union contracts provide that employees will receive written performance standards pertaining to their job, so that they will know what they are expected to accomplish in a day's work. This would include the number of claims to be processed per day, the number of pieces of correspondence to be produced, etc. in order to receive ratings such as "fully satisfactory," "outstanding," "below satisfactory."

d. Agency Monitoring Practices That Have Generated Controversy

When federal union officials are asked about VDT monitoring in the federal government, the picture they paint is one of "a few bad places, and very bad -- in the sweatshop mold."[82] Examples given were the "production shops" at agencies like "Department of Education," "Labor," "Treasury," and -- the most widely cited -- the Social Security Administration. The Postal Service was also cited as a "terrible monitoring environment."

(1) The Social Security Administration

We did not do a site visit to SSA as part of our VDT project. We wrote SSA originally in our inquiry letter to federal agencies, and again in December. As of May 10, 1985, we had not received a reply and therefore cannot present SSA's position directly. Therefore, we will report here what union officials told us, and what has appeared on SSA in a detailed, interview-based Washington *Post* series in 1984 on work monitoring. It would be important for OTA to obtain SSA's response to what appears here, to insure that facts asserted and positions taken are well documented from both sides.

The Washington *Post*, on September 3, 1984, ran the following profile of work monitoring in SSA's data entry operation in Wilkes Barre, Pennsylvania.[83]

Rising Performance Standards Keep Some in Agency on Edge

In the Appalachian coal country of Wilkes Barre, Pa., one of the largest and busiest factories in Luzerne County produces a product unlike those of neighboring industrial workplaces: millions of bits of electronic data.

There, about 1,000 federal workers, almost all women, transcribe facts and figures from 131 million W-2 payroll forms a year into the computer banks at one of three regional data centers of the Social Security Administration.

SSA data transcription "has to be one of the most boring and tedious jobs that there is," said Joseph Corcoran, a nine-year SSA veteran. "On top of that, you might have to 'key' about 150 records an hour, and that adds to the stress."

Security measures such as employe identification codes, which the SSA originated in the 1970s to detect fraud, now lend themselves to computer monitoring of individual productivity and to the adoption of performance standards.

SSA's Motorola video terminals keep a running count, which operators can see, of the number of forms keyed that day. Daily results are entered into a second computer system that captures what the SSA calls "work experience data" used for employe evaluations.

A primary complaint about the monitoring is that performance standards are periodically changed, so that workers who were required to key 115 forms per hour now may have to do a minimum of 138, a 20 percent increase, said Corcoran, who is president of Local 2809 of the American Federation of Government Employees. In some types of work, the standards have increased 50 percent or more in the last few years, he said.

"For a small percentage of employes, the standards per hour are not really a big thing because they are fast. But for a large percentage of people, it is a big thing. When they raise the standards another 15 items an hour, it's tough to make, especially if you had trouble meeting the old standard," Corcoran said.

"So you end up sitting at the machine longer. If you have to go to the bathroom, you don't go till you make 165," he said. "People handle tension differently. While others can do the 165, go have a smoke and even get a head start on the next hour's work . . . some people are forced to work in high gear all the time. It is like a car. If you are constantly racing it at high gear, it will start to burn out. And what [management] said in effect was that if people start to burn out, then call me."

Carolyn Pekarski, a 13-year veteran at Wilkes Barre, said that in the past, overzealous supervisors have confronted workers, including her, with computer printouts that detailed the length of time lapses in which a worker failed to enter data. The printouts showed the speed of the faster and slower workers, she said, "and the supervisor will say, 'So-and-so is doing this much, why can't you?' It gets very stressful."

Corcoran said Local 2809 recently completed a health survey of 62 data transcribers and found that about half of them reported frequent complaints of extreme fatigue; neck, shoulder and back pain; eye strain and irritability. The findings mirror various federal studies of video display terminal operators whose work is considered among the most stressful of all occupations, according to the National Institute of Occupational Safety and Health.

"Most of the workers are females who happen to have a couple of kids. They have a home where they are expected to cook meals, wash clothes, deal with kids. And they say the stress they feel on the job filters into their home life, that they are not able to cope with things at home as much as they should. I think that means more domestic troubles and all sorts of troubles," Corcoran said.

Edward P. Arthur, director of the SSA office of central records operations, said that while he was not familiar with the union's health survey, the SSA is studying the health and working conditions of data entry workers in response to what he called "universal" concern about the uncertain health effects of VDT operations.

Arthur said that performance standards, drafted with the aid of the SSA's "manpower utilization" experts, are reasonable because they are aimed at the speed of typical workers.

Arthur said that since 1982 the entire Wilkes Barre work force has been able to meet the SSA minimum, and that last year, for instance, 41.5 percent of the workers received ratings that exceeded the satisfactory level.

Those whose overall performance is rated outstanding are eligible for cash awards, Arthur said. So far this year, 85 workers have received bonuses averaging $305.

Standards are changed each year, he said, because of changes in the total work load of processing every American's W-2 forms and because of technological changes that affect the speed of the work itself.

"You look at the performance you are getting for the money you are spending," he said. "If the standards are too high, experience will show it and we will lower it," he said.

The union has challenged the SSA computer-monitored performance standards under provisions of the Civil Service Reform Act, but arbitrators have ruled that the SSA's actions fell within its management rights.

—*Peter Perl*

Our conversations with headquarters and local union officials representing employees at SSA indicated that they regarded union-management relations as "adversarial" rather than "cooperative."[84] The union has no trouble with the teleservice operations of SSA, where monitoring is not done, they report. It is the data entry shops and claims processing operations where the union feels that "unfair" quotas and "unfair monitoring" are taking place. However, because of the "management rights" clause in federal labor relations the unions have not been able to challenge these practices directly in bargaining. Furthermore, these union officials report that joint labor-management committees and quality circle approaches used successfully by some unions in the public sector to raise standards and measurement issues (see the IRS-Treasury Employees profile later in this report) or by some private-sector unions (see the CWA-AT&T profile later) are not feasible at SSA. "Those ways don't work here," a local leader of the American Federation of Government Employees stated.[85]

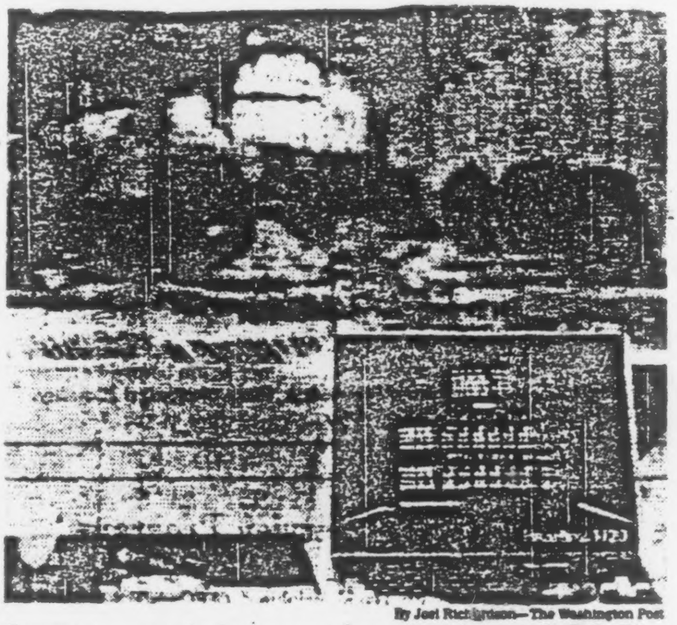
(2) The Postal Service

Though not a "federal agency," the U.S. Postal Service deserves treatment somewhere in our report, and we will put this here, in the most closely related sector for postal operations. We will rely on Congressional hearings and published materials, plus our union interviews, for our presentation, since we did not visit the Postal Service. We were also unsuccessful in getting a Postal Service spokesman to talk with us about these issues. Therefore, OTA will want to obtain the Postal Service's comments as to its alleged practices, and charges made by the American Postal Services Union.

We begin with a Washington *Post* story in September of 1984, which focuses on the way that supervisory use of monitoring is used in Washington's main Post Office.[86]

ne Washington Post
ept. 2, 1984

Monitoring by Computers Sparks Employe Concerns


By Joel Richardson—The Washington Post
Computer screen shows progress of postal employes at D.C. facility.

irst of two articles

By Peter Perl
ashington Post Staff Writer

echanical arm seizes en- and shoves them onto a r that moves relentlessly of Patricia Johnson's key- n the midnight shift at ton's cavernous main ce.

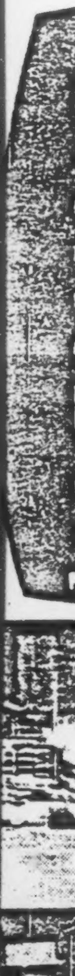
TCHING THE ORKPLACE

rate of 50 letters per Johnson, in a split second, member all the thousands esses within the 20017 18 zip codes of Northeast ton and must punch, by , the proper two-digit route each piece of the 's mail to one of 70 letter

e past, supervisors would e her performance by g her or examining a her work. But now, her sor sits at a video screen. a computer keyboard. n immediately see how istakes Johnson is making. ccuracy falls below 95 per- an extended period, John- be fired.

mail is running by me and by me, and the machine hypnotizes you," Johnson nd this computer is looking ur shoulder, watching you. very stressful . . . . The isor knows everything you, right in that machine."

son, 30, the single parent 1-year-old boy, is one of a g number of American rs who no longer labor sole- er the watchful eyes of the or the foreman. Now, mil- of blue-collar and white-col- nployes are working under ven more watchful and re- ss scrutiny of the computer. . . .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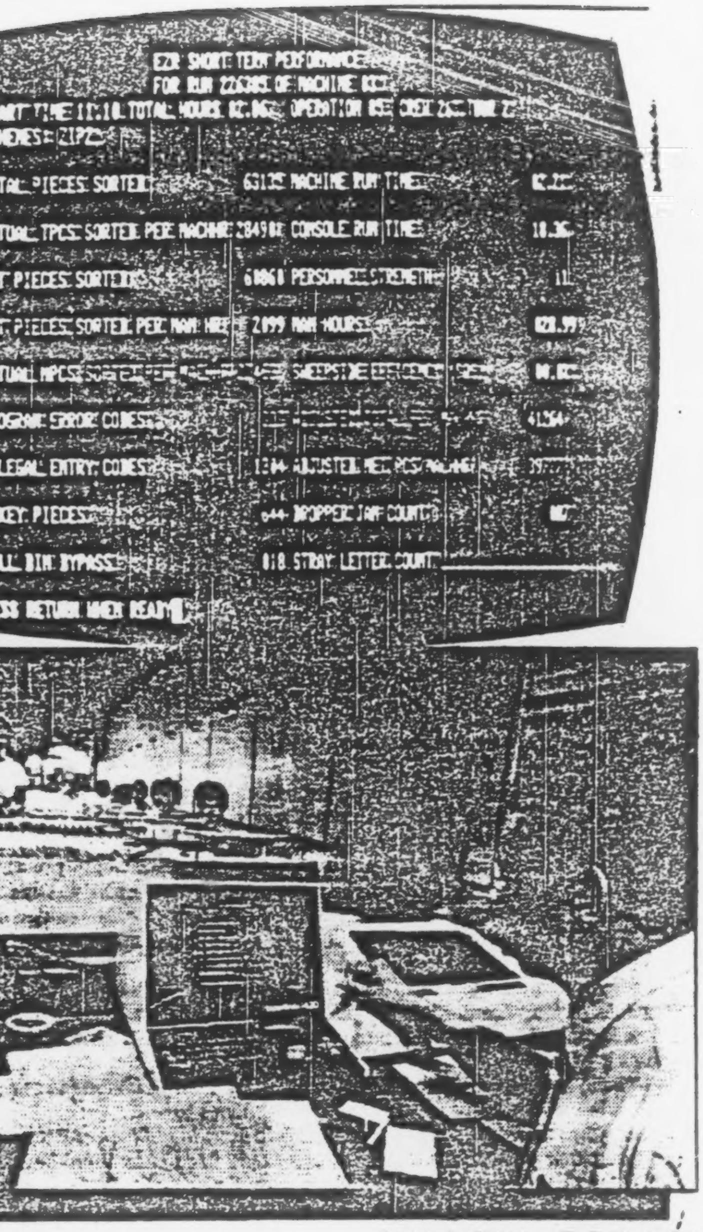


Photos by Joel Richardson—The Washington Post

r is used by postal officials to analyze workers' speed and accuracy and ms. Employes often don't know when supervisors are monitoring them.

High-Tech Tensions

Patricia Johnson came to the Washington post office 12 years ago. She has long since mastered her job, she believes, and she usually has an accuracy rate of about 99 percent at the 50-per-minute pace of the letter-sorting machine. But as she sits in a row of 12 mechanical sorting machines—with a supervisor at the video screen monitoring her and the other operators—the tensions can be maddening, she said.

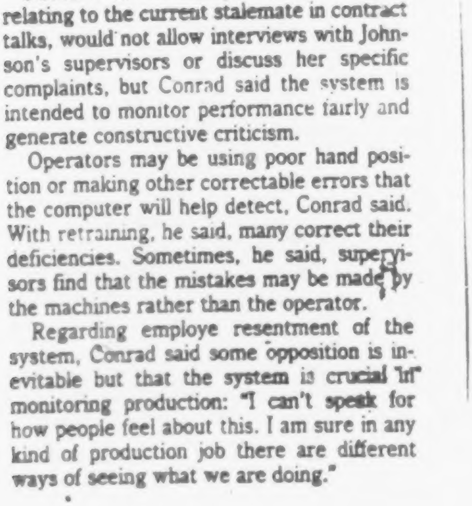
"The noise is incredible . . . . A lot of people wear their Walkman [radios]. You have hundreds of people, and tremendous noise, and tremendous heat. The air-conditioning breaks down quite often too," she said. "And it's like you are strapped into that machine. You gotta have your rhythm. Rhythm is everything. The average employe is a good keyer, but you can become hypnotized. Those machines can hypnotize you."

Adding to the tension, she said, is uncertainty about whether the supervisor is scrutinizing her work. The worker never knows, she said, whether the supervisor is watching, or just what he is watching. "Without getting up from his desk," she said, "he can see what you are keying in, whether you missed a character or only keyed in one digit instead of two. Or if you miss the hit altogether" as the envelopes whiz by.

"People are human and you have all different kinds of supervisors," good and bad, Johnson said. "But it's like overseers sometimes, watching and walking and walking and watching."

Carl H. Robinson, president of the 2,500-member D.C. Local of the American Postal Workers Union, said employe failure to keep up the required 95 percent accuracy rate results in about five dismissals per year, which are carried out only after attempts at remedial training. But sometimes, he said, the Postal Service is heavy-handed in failing to consider the "human aspect" of why a worker has trouble: "They're only concerned with productivity."

The Postal Service, with its abundance of acronyms, calls its monitoring systems EDIT and EZR—the Engineered Data Isolation Technique and the Electronic Zip Retrofit—and uses them not only to monitor employes but also to monitor machines, said Postal Service spokesman George Conrad.



Postal officials, citing employe tensions relating to the current stalemate in contract talks, would not allow interviews with Johnson's supervisors or discuss her specific complaints, but Conrad said the system is intended to monitor performance fairly and generate constructive criticism.

Operators may be using poor hand position or making other correctable errors that the computer will help detect, Conrad said. With retraining, he said, many correct their deficiencies. Sometimes, he said, supervisors find that the mistakes may be made by the machines rather than the operator.

Regarding employe resentment of the system, Conrad said some opposition is inevitable but that the system is crucial in monitoring production: "I can't speak for how people feel about this. I am sure in any kind of production job there are different ways of seeing what we are doing."

American Postal Union officials we spoke with began by noting that postal employees have been visually monitored throughout the Post Office's history (see our pre-OA baseline), and that fighting against "catwalk peepers, microphones planted in rest rooms, cameras watching mail sorting, and now, electronic machine monitoring is part of the postal scene. Postal employees work under surveillance already, constantly."[87] At one level, the union has worked out a modus vivendi with the management that monitoring by machine is acceptable as long as the figures obtained are used for retraining, improving procedures, and balancing work loads, not for "reprimanding or controlling employees." The union looks at production quotas and work standards to see whether these reflect what an "average employee can do," not "some laboratory model under perfect conditions that an efficiency expert has dreamed up." The union has worked to get "fair" standards for all kinds of pre-VDT jobs and has taken those cases into arbitration; it views its role now with VDTs as a continuation of that process.

In one area, however, the APWU has tied injuries to postal workers to the work quotas set by the management. This involves some 5,000 postal employees using VDTs in a computerized mail forwarding system.[88]

The APWU has collected health-impact data from its members using the mail forwarding system (CMFS). It has also commissioned two health studies, one in Minneapolis and one in New Jersey. It alleges that 24 out of 46 workers using VDTs in this system at the Minneapolis unit "have had occupational diseases diagnosed either by their own doctor or by the Postal Service doctor in Minneapolis," and seven additional employees have had "hand, arm and wrist problems" and are awaiting medical evaluation. The primary problems are carpal tunnel disease, tendonitis, and epicondilitis.

The APWU believes that the problems are caused by a combination of improperly designed terminals for this task, poor ergonomic conditions, and the "dangerously high" work-quotas set for each operator. The crux of the problem seems to be that a CMFS operator must depress a key on the right-hand side of the keyboard to order a label printed with a change of address, for a postal patron whose mail is being re-directed. The placement of that key requires that the little finger of the right hand reach over a significant distance to accomplish that task, causing strain on the tendon. The APWU expert we talked with believes that a split space bar, to be used by the thumb, would solve a good bit of this problem. (Other issues involve the terminals being at the wrong height on standard desks, and similar problems.) What needs underlining about this issue is that the union is protesting against machine-paced work and "dangerously high" work quotas, not the record-keeping and "surveillance" aspect of VDT use. While the two issues are often joined -- machine pacing and machine monitoring -- it is important to note the different problems each raises, and to recognize that machine monitoring of fair work quotas and quality as well as quantity aspects changes the character of the situation significantly.

e. Examples of Cooperative Labor-Management or Employee Relations in High-Production Settings

We can provide several examples of situations in which agencies have used work monitoring for VDT operators in ways that have drawn positive employee and/or union responses.

(1) Department of Justice Employee Data Service

The Employee Data Service of the Department of Justice handles payroll for 41,000 employees in the DOJ. About 48 employees work in this heavy production unit (80% female and 20% male), and "overwork" is the daily condition in the unit. "We would need 10-12 more people to catch up and keep up with our work load," the director of this unit feels.[89] The VDT operators key in documents, there is an edit program, and an error program that kicks out those mistakes for which programming can note the error. Periodically, other workers check for keystroke error. Pay is by the hour, and people stay until the work required for the day gets done, receiving time and a half for hours over eight per day.

Presently, employees working as "contract" persons have their production monitored and their errors calculated, and this is used in performance evaluation. This system will be extended soon to the full-time employees. Management has presented the work standards, error calculation system, and performance procedures to the local American Federation of Government Employees union representative. The union looks to see whether the standard is fair for average workers, and whether the discussion process with the employee is full, fair, and "realistic." Under the contract, the local union participates in setting the standard and the evaluation procedure; it can also represent the employee in any problems that arise in applying the system, at the performance evaluation time.

There has never been union opposition to work monitoring as such in this unit. As long as it is done openly and fairly, the use of monitoring has been satisfactory to the union, the employees, and management. The director emphasized that monitoring as they do it gives employees recognition for the accurate and high quality work they do, and allows for promotions and other recognition. "We wouldn't want a shop where people don't get recognition for the effort and skill they contribute," the unit's director told us.[90] Prior to the new director putting this system in (October, 1984), he felt "there was lots of fear by the employees, because they didn't know what was expected of them for satisfactory performance, and what they had to exceed to get promotions." "The system we put in has been a great relief to employees. Having specific figures of total group performance, plus each individual operator, was also helpful in discussing the standards with the union, as to what would be fair."

The concept of "fairness" at the DOG Employee Data Service has been seen as embracing several elements:

- It must take "the ups and downs of work into account."
- When work influx increases dramatically, and "keeping up" is critical, the accuracy standard has to be decreased.
- When the pressure gets too great on any individual operator, management will redistribute the load rather than expect "heroic" effort.

(2) The Internal Revenue Service

IRS has about 25,000 clerical employees working in its 10 service centers during tax return filing periods, about 9,000 of them using VDTs. They are of two types: data entry workers and telecommunication operators using a computer-based call controller, with display board. All these employees have individual performance data collected by machine (software-generated) statistics. (IRS has traditionally used production monitoring in its pre-VDT data-entry operations.)

Working with local union committees of the National Treasury Employees Union in six of the 10 local service centers, the IRS has developed a joint labor-management Incentive Pay Program that has work monitoring as one of its key elements. Local union-management committees can select either keystrokes or documents as their measure for productivity. The goal of the program is to attempt to return to the individual operator 50% of the savings realized by increased productivity and quality through the VDT/productivity program, as "incentive pay" beyond regular pay.[91]

Employees can opt to participate in the incentive pay program or not to do so. They can see their own printout at any time, in daily or weekly form. The union has access to all production statistics generated by the system.

The reporting on individual employees is done through a combination of machine generated statistics and employee reporting of production data and hours on a special form. Error rates reduce total keystroke or document production counts, so that employees must address accuracy as well as speed. The form contains five critical elements, set up for each specific type of VDT job. Three evaluation levels are used: "satisfactory," "unsatisfactory," and "superior."

Both union and management officials we interviewed say that employees like the system.[92] The local union committees are positive about the way that standards of quantity and accuracy are set, and the way that "substantial additional pay" is being achieved by participating employees. Management feels that the improvement of work rates and accuracy rates is "very satisfactory." However, the IRS has not tried to do strict pre and post-experimant productivity studies. They feel that recent changes in tax forms and rules make scientific comparisons impossible.

6. Summary of Federal Agency Practices

The Federal Executive Branch displays the full range of clerical VDT work monitoring policies and employee/union reactions that we found in the private sector. These range from heavy VDT operations that do not collect individual-operator statistics to continuous monitoring of individual operator output and its use for evaluating performance and making incentive payments. We also found that while federal unions are all opposed, in principle, to "machine pacing" and "machine monitoring," applications by management in which unions participate and that are considered "fair" as to work level and evaluation procedure have drawn positive reactions from local and national union officials. Federal employees individually also demonstrate the basic split among VDT workers between those who feel any monitoring is "unfair surveillance" and used to "control them" and those who feel that this provides an objective measure of their performance that -- in the hands of a fair management -- will recognize their achievements and win them better pay or upgrades that would otherwise depend on "personal" and "subjective" judgments of supervisors.

H. Work Monitoring in the Corporate World

A 1984 article in Dun's Business Month provides a useful series of vignettes showing how large firms are using individual monitoring of VDT service work. These profiles match those of similar companies that we visited which are using evaluative monitoring for VDT-intensive jobs:[93]

> - "American Express uses them to monitor the data-entry personnel who record account payments and the operators who answer phone queries from credit card holders, among others. The company, which gets some 20 million phone calls a year, considers the speed of response part of the quality of its customer service, explains Senior Vice President Edward Sherin.
>
>   The monitoring system measures the average time it takes to answer a call (the goal is ten seconds or two-to-three rings) and the time each representative spends with each

caller. The system reports this data per operator, per unit and for the 500 people in the organization. To assess service quality, supervisors listen in and rate each operator once a day on the time the operator takes for the greeting, to get to the point, to give the answer, and courtesy.

According to Sherin, gains in productivity units (production in relation to staff) in the past two years show an overall rise of 5% a year. As a consequence, he boasts, 'We have added less staff in proportion to the gain in volume of business.'"

- "At the Third National Bank of Nashville, First Vice President Ronald Robinson, director of operations, started a productivity program in February 1981 for the 33 machine operators who encode the dollar amounts on checks to make them readable by computer. Using a software program to count the rows, or 'fields,' of numbers each machine operator encoded, Robinson increased productivity standards from the average 900 fields per hour then being realized to a minimum acceptable rate of 1,000 fields. Employees who failed to make the grade were retrained until they succeeded or were transferred within the bank.

Before monitoring started, Robinson paid encoders the minimum wage. Now he pays the minimum for 1,000 fields and a bonus of varying amounts for each 100 fields achieved above that. The result: Encoding production is up 55% to 1,400 fields an hour; the encoders are making more money; and the employee turnover rate has dropped from 70% to 20%. 'The program is fantastic,' Robinson says."

- "Another enthusiast is Scott Byer, vice president of group operations at Equitable Life Assurance Society, which has been using computers to monitor its processors of group health and disability claims since July 1982. Because all claims are not equal in difficulty or length, the computer must analyze the characteristics of each claim an approver processes each day and then assign the claim a unit of productivity depending on complexity.

  Equitable evaluates each approver every six months and grants salary increases or assesses decreases depending on performance. Substantial productivity gains resulting from the program, Byer reports, have allowed the company to cut its claims processing staff from 3,000 to 2,000-to-2,500. 'We are paying 20% more claims with 25%-to-30% fewer people,' he says."

- "Similar improvements are reported for a computer program that monitors classified advertising sales employees at The New York Times to distinguish between the time they spend writing and processing ad copy and the time spent in selling. By linking incentive bonuses to improved employee efficiency, the company says it has raised employee earnings, improved customer service and increased classified advertising revenues."

One important point shown by our site visits and interviews is that many small and medium sized businesses, not just large firms, are using computer monitoring for VDT-intensive clerical jobs.

- At one small mail-order jewelry firm in a metropolitan area that sells low-cost diamond rings, five operators verify customer orders, trace invoices, enter refund amounts, and perform similar operations at their VDT keyboards, accessing a customer data base. Their work is monitored by computer printouts and also by surveillance cameras used by this firm both for security purposes and to watch employee performance. A former employee we interviewed recalled that "they used the cameras to watch how hard you seemed to be working, when you got up to stretch or take a break, and your 'attitude' at work. It was really a totally monitored place." This woman was not granted the standard raise after six months of "probationary" work at minimum wage -- even though this was recommended by her supervisor -- because the management said she "didn't look like she was working that hard" when they observed her on the camera. She had no access to her own production figures or to those of other employees with which to challenge that judgment, nor were there stated production standards she could rely on even if she had any complaint procedure. She quit, as did many of the women working in this small shop after their first six months. The management saw such heavy turnover as quite all right, since they had a steady supply of trained VDT operators willing to take "probationary" pay, and the firm did not need operators knowledgeable about the business to do the data entry work involved.

Most of our site visits, however, were done at large sized business firms. Looking at these organizations, the picture is slightly different than the overall pattern of monitoring we described on pages 60-61, for all the organizations we visited. Reflecting the early entry of large business firms into office automation, and their use of work measurement practices in pre-OA office-production jobs, the pattern of VDT monitoring among the business firms we visited was as follows:

- Virtually all business firms are collecting operator statistics on some clerical operations in their organization. Depending on the business, this may involve a large number of clericals or only a few small units, such as a "data entry shop."

- A small minority of firms, perhaps 10%, said they used machine monitoring only for group evaluation, planning, and cost-justification analyses. These firms stressed that supervisors were able to judge individual operators well enough in their operations without needing performance printouts, and that concerns over the quality of work and the unevenness of customer or transaction demands did not make measurements of transactions useful in those enterprises.
- In the remaining business firms, about 90%, individual operator monitoring was used in some way for employee evaluations. Our judgment is that two-thirds of these business firms were using monitoring in what could be called "traditional productivity modes," and about a third had developed what we will call "fair measurement" approaches that stressed privacy-related and employee-involvement mechanisms.

We turn now to describe examples of the assumptions and practices of the business firms using monitoring for employee evaluations.

1. VDT Monitoring in "Traditional-Productivity Modes"

At about two-thirds of the business firms we visited, what could be called "traditional-productivity modes" were being applied to clerical VDT work, especially to data entry, customer service, and claims processing jobs. Critics call these "Taylor factory models" or "scientific-management control" techniques being transferred to the new technological settings of office work. Business spokespersons defend these as thoroughly fair methods geared to insure efficient operations, well within the capabilities of average workers.

We noted two main variations in the use of such traditional-productivity modes of VDT monitoring. In some, managements felt that quantity of output and speed was so critical to the successful operation of their enterprises that they made this the dominant element in their performance standards, with the VDT-generated records of quantity, speed, and time-working used as the critical elements of evaluation. While almost all such firms stressed that they were also concerned about achieving low error rates in data entry work, for example, or meeting special customer concerns on telephone contacts, their systems made quantitative measures the driving force of their monitoring programs.

How employees we interviewed felt about such systems, in both unionized and non-union settings, depended on factors such as how well quantity/speed standards reflected the reality of VDT jobs and working conditions; how well system problems in new or changing OA applications were recognized; and whether supervisors applying standards were seen as fair or punitive.

These factors were well illustrated by the experience of a large, non-union distributing company we visited which introduced a VDT customer-ordering system in the 1970s. The business involved was one in which total volume of units sold in the nation was steadily declining, discount sales threatened traditional profit margins, and the basic profitability of the enterprise was ~~threa~~tened. This firm turned to new technology as one important way to meet the challenge, and also adopted techniques of detailed productivity measurement that had not been used in this firm previously.

> A special work productivity unit was created which did time-method-and-motion studies, set strict quotas, and generated detailed records on each VDT operator. Employee morale dropped and turnover rose to 80%. "Everything was numbers," one executive recalled, with "no attention to the downtime and slow-response-time problems of the new system, or the changes in volumes operators faced during peak periods, or of the different length and complexity of customer orders." In addition, improperly filled orders increased under the pressure operators felt to raise their total of orders completed per day. The productivity system was scrapped after several years of operation. A new approach was instituted that still collects individual operator statistics but has standards geared to actual system operations and load cycles. In addition, as part of an overall "Quality First" campaign in this firm, the new performance standards stress "order quality" over "sheer numbers." Several dozen long-term employees we interviewed said that the first productivity system was a "very bad time" at the company, but that the new approach is "fair to both company and employees," and they have no trouble in meeting both the quantity and quality standards.

At a medium-sized suburban newspaper, customer-service employees felt that the record-keeping done by the VDT system in the circulation and classified-ad departments had been fairly applied from the earliest days of these systems.

- Alice, employed three years at this newspaper, had worked previously doing non-VDT order entry at a manufacturing company. She said she liked working on the VDT very much. She cited the ability to see what you are entering "come right up on the screen," to be able to call up data base information to help the customer, and to spot troubles for the customer and "fix them right away." The management has a daily job chart that records each operator's time on and off the machine, errors made, and accounts handled. "I don't mind that at all," Alice said. "They don't judge us on the numbers here; they take into account changes in the business service we are making, and the way customers -- some of them -- need more service than others. It's not a Big Brother thing." She explained that sometimes customers call to complain but not to start or stop a subscription, and if the employer was only after "subs numbers," they would be "docked for time that did not produce an actual transaction. This isn't done. As a result, Alice said "I don't feel they're looking over my shoulder wrongly. I'm comfortable with the supervision here." She also noted that management's attitude led employees to cooperate informally to take heavy loads off one another when the calls piled up at one or two stations. "We can do that because we know it doesn't penalize anyone to share work this way." Alice also said that pay was "OK" but not "great" at this newspaper, but she liked the job very much because "the benefits are excellent, you can take courses at night and have the company pay for it, and people you work with are fun to be with."

How important the balance between quantity and quality was in a traditionally-oriented system was shown at a large public utility, with union representation.

- At this firm, counts are made of the customer-service calls that operators handle. However, the count is weighted so that operators working on larger amounts due and more complex payment plans receive more credit than simpler calls that can be handled faster. "Our whole approach," the manager of this unit explained, "is focused on quality," and our strong instincts about who is working well, which "we trust more than machine statistics." The manager explained that "some productivity programs look wonderful on paper, but they won't work in real job environments. If they aren't fair, and fine-tuned to the job being done, they can easily be defeated by the employee. They can always find ways to make the figures look better for them, and defeat the whole purpose of a productivity drive. We aren't a factory here, with production line quotas. In an office, doing customer service work, its people you are dealing with, and relations with people count the most. It's quality of

> service we go for here, not call counts and line counts. And the employees know that, and appreciate it." Our employee interviews found high satisfaction with the evaluation system at this firm, and the local union said it "had no problems" with work evaluation procedures.

Another example of general employee satisfaction with a traditional productivity measurement approach was at a large non-union financial company, using a VDT-telecommunication system in collection work. This firm had gone from a system that had used telephones plus manual records to a system that had a dial telephone plus a VDT database, and, most recently, to a system that combines an automated telephone call-up of customers with a screen display of that customer's account. Through all three of these successive systems, the company had collected detailed transaction records on individual collection operators, using these to give individual and group "recognition awards" for excellence, evaluate each operator for annual salary-level increases, and help decide on promotions to lead operator or supervisor. In this firm, quantity of output was used as one measure of performance in an eleven-factor evaluation system. (The form used, with the factors listed, is reproduced on the next page, as Figure 2.)

We interviewed several dozen employees at this firm. They were overwhelmingly satisfied with the way individual output was measured, and the balanced quantity/quality/attitude/attendance oriented employee evaluation system that was being used. In fact, employees who were good at collections work said they would be very unhappy at any system that used only "group performance" and did not record how well they are doing individually. These employees felt they were excellent performers, and they wanted the high salary-grade increases each year and other recognition that went along with their achievement. As one woman put it, "We wouldn't want to be dependent only on the subjective judgments of a supervisor, who might be someone you didn't get along with so well."

Figure 2: Mixed-Factor Performance Evaluation System for VDT Customer Service Operators, Large Non-Union Firm

EMPLOYEE EVALUATION WORKSHEET

NAME____________________ MONTH/YEAR____________________

EVALUATION RATING________________

CRITERIA		
1. QUALITY OF WORK PRODUCED		
2. VOLUME OF WORK PRODUCED		
3. COMMUNICATES EFFECTIVELY WITH EMPLOYEES, SUPERVISORS, CUSTOMERS, ETC.		
4. WORKING WITHOUT CLOSE SUPERVISION		
5. KNOWLEDGE, UNDERSTANDING & TECHNICAL USE OF ROUTINES & PROCEDURES		
6. CONCLUDES ASSIGNED DUTIES IN A TIMELY MANNER		
7. MEETS CHANGING DEMANDS OF THE WORK SITUATION		
8. WORKING WITH OTHERS		
9. WORK HABITS		
10. ADHERENCE TO WORK SCHEDULE		
11. ATTENDANCE DAYS OUT...........		

EMPLOYEE SIGNATURE____________________ DATE________ MANAGER'S SIGNATURE________________ DATE___

Two examples of disputes over the application of traditional productivity models to VDT clerical work will illustrate the controversies that have arisen over these methods. The first involves telephone company customer-service work.

Monitoring by the Bell System of directory assistance and long-distance telephone operators which we discussed in the pre-OTA and transition eras, carried over into VDT jobs in the 1980s. Many telephone operators we interviewed bristled with anger at the production standards and work monitoring practices used by AT&T in the AWT (Average Work Time) system. Operators noted that the system puts in each operator's personal ID; the date each day; and how many times they plug into or out of their position; how many hours and minutes are worked each day; how many "position calls" are handled per second, per minute, per day; the total work volume, and then a AWT percentage figure. Operators are expected to handle a call in 30 seconds or less, and to achieve a 96.0 or better AWT percentage. If an operator did not have 96.0 or higher for three consecutive months, she or he would not be granted an upgrade, could be identified as needing "training," or could be disciplined by the supervisor. One telephone operator described the problem she saw with the AWT administration as follows:[94]

> Management would like everyone to exceed this figure of 96.0, so in return some operators try very hard in many ways to exceed it. The problem with this is that some of the customers we are helping are getting very poor service, and in some cases, no service.
>
> If the company would really look at AWT's honestly, they would realize that by having this type of measurement they are causing the operator to give poor service and in return are losing the respect of our customers.
>
> We no longer are considered as caring and helpful operators. We get many complaints that the operator did not stay with the customer's call and follow through.

> Why AWT's? Many of our customers are very dissatisfied with our service, and are going to other telephone companies. We are losing a lot of revenue, plus the stigma of being a rude and unhelpful company.
>
> That is what AWT's have done for our company -- What price is the right price in the name of progress?

These concerns expressed about telephone-company-management reliance on the AWT system are not hypothetical ones. In 1983, for example, a veteran telephone operator in Baltimore working for the Chesapeake and Ohio Telephone Company was fired for taking "too much time" with callers. The company said that Maevon Garrett averaged three seconds longer than the company's AWT productivity standard of 30 seconds per call. Garrett -- who was also a union officer and spent a limited time per month on operator duties -- said her exceeding the average was because she refused to cut short calls from "people who are hard of hearing or who have difficulty with the English language." The Communication Workers won her reinstatement after newspapers and television publicized her case, but she was still given a two-week suspension for spending "excessive time" with customers.[95]

AT&T's position, as given to us by company officials, is that it sets AWT standards only as a guideline to show employees what is needed for the company to provide service at a price that will meet its growing competition for telephone service. Monitoring of quantity by software in the VDT system and sampling of conversations by supervisors is not used for disciplinary or "punitive" purposes, company officials say, but to identify operators whose "consistent" record of taking longer on calls requires supervisors to see what explains that fact, and to provide better training or coaching so that the employee achieves the standard as an average, over thousands of calls. AT&T officials say that if some local supervisors have used the AWT standard for disciplinary purposes, that violates company policies, and is not something that would be continued if it is exposed, though they acknowledge that "a few over-zealous supervisors" may have done this in the past. Company officials also believe that, in the past, the Communication Workers union has made the "monitoring issue" a highly emotional one at its conventions and in public statements, to suit union purposes, rather than working cooperatively with the management to deal with any excesses or misuses that may have occurred.

(For a discussion of some current efforts at cooperation between the CWA and Bell Operating Companies, see the later section on innovative approaches to work monitoring.)

The second example of controversy over traditional productivity models applied to VDT clerical work involves the claims processing office of Equitable Life Assurance Society in Syracuse, New York, which was successfully organized in 1982 by an affiliate of the Service Employees International Union.

In 1979-80, Equitable began implementing a company-wide automated claims system for health insurance. Previously, claims-approving was a "semi-skilled" job that was done manually, using data sheets, with various filing activities and telephone work included in the daily routine. With automation, claims approving became essentially a data-entry job; clerks spend almost all their nine and a quarter hours a day, four days a week, keyboarding claims data into the data base, via video display terminal. Most of the approval-rejection functions are built into the system software. In its 1982 Annual Report, Equitable describes its "Equi-Claims System" as "the most sophisticated computerized system in the industry..."

At Equitable's Syracuse office, many of the 90 women claims approvers did not regard this changeover as one for the better. Jane Ratner, a former school teacher who had worked under the manual system, said she had never expected to be doing such work as an office employee. "I'm a factory worker, that's the way I feel. The way our office is set up, it's a whole line of computers. We're all lined up. We all face the same direction. And all we do is punch keys all day long."

In late 1980 and early 1981, some of the Syracuse claims processors said they tried to get management to look at problems arising from the way the company was applying automation. As one employee recalled this: "We raised questions about the work procedures, about glare and eyestrain, about 'dirty curtains' and annoying 'paper fleas,' and about the ergonomic and health issues being presented on national television and in the press. We wanted to work with the management to make things run better."

In the employees' view, the Syracuse Equitable management was not responsive to any of these concerns. Some issues they felt management simply rejected; others they said were explained as "management decisions" that just had to be accepted; some things "they promised to look into but nothing was ever done." On the health questions, the supervisor approached said: "There's nothing to that. Don't start making trouble in the office." According to the employees, Equitable did not have any Quality Circles or other employee-involvement programs for these workers, where such issues could be raised. Several employees remarked that they felt they knew more about problems and bad effects from the new computer system than the management did; "but management basicallv told us, shut up and key-in your data."

Machine monitoring of the claims approvers was a central issue in the union organizing campaign, in the contract negotiations that followed, and in the contract terms approved in 1984. In testimony before a House Subcommittee in 1984,[96] one woman clerical worker in Syracuse, Rebecca Alford, discussed monitoring in these words:

> The electronic monitoring is one of the most offensive and pernicious aspects of our jobs. 1984 is nowhere more apparent than in the electronically-monitored Equitable office. We 'clock in' at 7 A.M. and from then until the end of the day, the VDT is counting every keystroke. At the end of the day, managers have a computer read-out from which productivity is determined and then averaged with subjective factors such as attitude to determine our rate of pay. Being watched, counted, and paced by a machine makes it very difficult to take pride in your work.

The Syracuse Equitable workers charged that printouts of their performance are given to supervisors, who use them to calculate pay. The employees also charged that the performance evaluation system included "subjective" factors such as "attitude" which management could use to discriminate against employees who complained about VDT working conditions or were leading the union campaign. Employees did not get to see the printouts, the employees charged, and were not able to challenge how their work is assessed. This was alleged to be a violation of Equitable's own "Employee Privacy" code, which says that employees can see the information used to make personnel judgments about them.

Equitable management defended its monitoring practices, saying most of its claims approvers across the country "like the objectivitiy" of the computer monitoring system, and do not experience a sense of "stress" as a result of its use. Company officials also defended the multi-factor performance evaluation system it used as a good balancing of quantity, quality, attitude, and attendance elements, denying that it had been used in a discriminatory way.[97]

(For a discussion of how monitoring was treated in the 1984 Equitable-SEIU contract, see the following section on labor relations actions involving monitoring.)

Finally, some managements using incentive pay systems based on work monitoring, especially in routine "heads-down" data entry jobs, defend this as "the only thing that makes this job worth while for women doing it." At a small data entry unit in a large insurance company, the unit manager said that the women who work there soon develop a high proficiency in putting the data in, and take home "very good pay -- much more than they could get working in a five and dime or a fast-food place. They can pace their effort according to how much 'extra' they need for themselves or their families, and know that they can raise their pay by putting extra effort in or just 'make standard' with average effort." Data entry employees at several firms we visited told us that this was an element that they liked to be able to decide for themselves, and they believed the company's system of standard and incentive pay was a good one for them.

2. "Fair Work Monitoring" Approaches

At about a third of the business firms using evaluative work monitoring, managements had developed policies for conducting work monitoring that recognized the special sensitivity of this practice, in light of social values of the 1980s, and had instructed their operating divisions and line supervisors in how to use any individual records in clerical work generated by VDT software. At IBM, for example, a Manager's Guide to The Visual Display Terminal Environment was issued in 1984 that set out rules for how VDT work was -- and was not -- to be evaluated. This Guide serves as one part of a manager's training course on VDT work that each of IBM's 50,000 managers, world wide, will be going through in 1984-85. The Guide places its discussion of monitoring in the context of IBM's overall philosophy and practices for planning and evaluating employee performance (See Figure 3).

Figure 3: IBM's Work Evaluation Approach in Using VDTs

Setting Objectives, Performance Planning, and Evaluation

One important reality of introducing VDT's is that they do change how the work is done and what is expected of employees. In some instances, due to the increased capabilities VDT's provide, a function's mission may actually be enlarged and the jobs of the people in it expanded. In other cases, VDT's may require the creation of an entirely new function. When this occurs, you must redefine the function's objectives and the responsibilities of the people within it.

Setting Objectives

Starting with the function, you should clearly define the overall objectives for the total organization and each department within it. Next, identify the type of information you will need to measure how well your function is meeting the stated objectives. Finally, decide what relevant data the VDT system can provide to help you measure your function's performance.

Performance Planning

Once the objectives are agreed upon, they must be related to all the individual jobs within the function. You should conduct a meeting with the entire function to explain your objectives and how the installation of VDT's will make it possible to achieve them. You should then plan for all managers within the function to conduct performance planning sessions with their employees. This will give each person a chance to understand the impact of VDT's on his or her own job.

During the individual performance planning sessions, each manager should discuss:

- What tasks or responsibilities are being changed;
- What new tasks or responsibilities (if any) are being added;
- What is expected in the job, specifically as it relates to the work done using the VDT; and
- What will be evaluated and how it will be measured.

Through this, you and your managers will have the opportunity to tailor the job to the employee, based on his or her stage of development. Since performance planning is a two-way process, each manager should be able to plan an assignment that meets the individual needs of the employee, provides the greatest level of job satisfaction, and achieves the objectives of the function.

Evaluation

The method of evaluating the performance of an employee who uses a VDT is very important since it may be possible to track a great deal of data using the system. It is essential that you evaluate your employees on the measurements you discuss with them during the performance planning process.

If some of the employee's performance will be measured using data from the VDT, be sure you explain exactly what will be tracked and why. Employees should not be measured on a purely quantitative basis, such as numbers of keystrokes. You should not monitor performance data on the VDT without an employee's knowledge. The data should be meaningful and relevant to the work being done. You should never include data in your evaluation that was not previously discussed with the employee.

We found "fair work evaluation" policies such as IBM's being used by other organizations we visited that have a reputation for innovative employee relations. These included banks, insurance companies, utilities, newspapers, hotels, airlines, manufacturers, and service companies. (For an analysis of what fair work evaluation approaches require, see the "Policy Analysis" section of this report.)

I. Work Monitoring in State and Local Government and the Non-Profit Sector

In our site visits, discussions with union staffs, and other interviews, we documented examples of no-data-collection, traditional-productivity models, and fair work evaluation approaches taking place in clerical operations of state and local government agencies and non-profit organizations quite similar to those we have documented for federal agencies and corporations. State and local government agencies seem to have about the same patterns as the federal government. However, in terms of organizational milieu and management style, there is generally less evaluative monitoring going on at private universities, religious bodies, civic groups, and similar non-profit organizations.

J. Monitoring of Professional and Management Personnel by VDT-Based Systems

Though we have concentrated our discussion on machine monitoring of clerical workers, we found that in some organizations, perhaps 10-15% of those we visited, productivity monitoring is being applied also in office systems developed for professional and management staffs. While these employees are usually better educated, better paid, and have higher social status than clericals, the effects of close monitoring done without appreciation of complex system performance and human reactions with it can raise problems similar to those in clerical work.

Here is a first-person account of how one loan officer and his colleagues at a major bank learned to hate -- and to defeat -- a productivity monitoring system imposed on their department.[98]

> "An individual loan administrator manages a portfolio of approximately 75 mortgages.... The job of the loan administrator involves a fastidious attention to detail. The computer system, called our Management Information System, (MIS) is a useful device for tracking important details such as due dates; these may include tax due dates, insurance due dates, investment roll-over dates, and the like.
>
> "Each employee is watched by the system, sort of like the realization of the Orwellian prediction. To be tracked on the system is to be monitored by it on a daily basis with regard to every conceivable item of work which could be performed on the job. The MIS does perform some essential functions in helping to manage the enormous work load, but often it was looked upon as an excuse for increasing the work load even more. Preparing the daily MIS input sheets at the end of the day is a dreaded duty, done hurriedly before leaving the office.
>
> "The MIS theoretically tracks every thing which the loan administrator performs during the course of the day (otherwise referred to as "demand time.") The entire job of the loan administrator is dissected into every minute function which might be performed. Each function is assigned a certain time standard for how long it should take to be performed. After the MIS is posted, the system calculates each worker's daily productivity as a percentage figure based on what

> the employee reported as having done that day. It is this aspect of the system which makes those who are watched on it distrustful of management because it seems like a management surveillance system.

The loan officer than explained the computer's "aging scale" which tracks how many financial statements are outstanding for borrower accounts assigned to each loan officer, and how many days overdue they are. The standard for such overdue items is 60 days.

> "When something goes out of standard, the loan administrator is severely upbraided, penalized and punished. Anything which goes out of standard on an employee's MIS automatically throws the department's MIS out of standard. Middle management can become quite tyrannical in its enforcement of the MIS, making the system that much more unpopular with the employees.
>
> "To avoid having things go out of standard on the MIS the employee can just get around the system by taking the particular item out of the system and entering it the next day, thereby turning back the clock on the aging report."

Another way to beat the system, the loan officer explained, is to put false items on the Daily Activities Report that will earn the loan officer high points under the system's rating scale, and bring his daily average up to where it is supposed to be. Since it is not easy for supervisors to verify that these particular transactions were carried out, the loan officer noted, "they can be used to inflate one's utilization and productivity rate." As a result, the Activity Reports often do not document what the loan officers are really doing, but what they put in to upgrade their productivity.

Summing up his judgment on the bank's monitoring system, the officer comments:

> "The system's shortcomings lie in the manner in which it is imposed by management. The preoccupation with the MIS itself distracts the loan administrator's attention from doing his job. The amount of paperwork generated for and by the system reduces its effectiveness because it becomes a consuming activity in and of itself. The MIS is viewed as part of the bank's bureaucratic organization, and it is constantly a source of frustration and annoyance to those who use it.
>
> "The bank has spent significant sums of money on these types of systems and their development over the years. They consider this one to be literally the 'state of the art" in MIS applications, and they are very proud to show the system off. They would do well to bring the level of their management expertise up to the standards of their management information systems."

Finally, we saw a few situations where monitoring systems were being applied to middle management, and where some were evoking the same negative reactions and manipulative responses as in the loan officer situation just cited. For example, in one company, headquarters announced it would institute a centralized monitoring system that would allow corporate staff to have on-line data about production, shipments, and so forth from each plant of shipping site on a constant basis. The plant manager that we interviewed was deeply angered by this plan, which he saw as a threat to good management. "Managers at my level should be accountable to corporate headquarters on a quarterly basis, not on an hour-by-hour monitoring of our time and decisions. It will just emphasize temporary negative events, and you'll be called on the carpet by top management whenever they look at the tube and see below-par figures." The plant manager felt that top management should let him manage without such "minute surveillance," which would only result in efforts to keep daily productivity up at the expense of much better productivity gains that could be achieved in a more up-and-down cycle.

This pinch of top management monitoring of middle managers was observed also by Dr. Craig Brod, in his recent book, Technostress. Brod writes:[99]

> "Middle managers also know that with computers they spend less time monitoring and more time being monitored. With computerization, quarterly reports become monthly or even weekly reports; if an unsound decision is made or an unlucky risk taken, there is less time to fix it before the next report points it out.
>
> "Bureaucrats or supervisors who are not accustomed to being watched over feel nervous that their work is now subject to monitoring from above, or perhaps by peers. But while clerical workers have no say in whether management counts their keystrokes or times their phone calls, managers and executives may simply choose not to commit sensitive information to the computer....
>
> "Jack is a manager for a computer manufacturing company. When he comes across a discrepancy in inventory, he writes it down on a sheet of paper; he doesn't use his terminal. He wants to avoid having the problem traced to him. Other managers at his company do the same, he says."

K. Union Positions and Protests on Work Monitoring

As we have documented in our pre-OA and transition-period profiles, opposition to setting "unfair standards, monitoring individual workers, and using those records for pay or discipline has been a traditional labor union position in the factory, and in those pre-OA office settings in which monitoring of production-type work or telephone service was conducted by employers. The additional aspects of intrusiveness and heightened stress that unions have associated with the continuous machine monitoring of VDT work has made this issue an important one for the labor movement as high technology enters office, service, and even some factory work (inventory VDT systems, for example). Their position has been shared by womens' activist groups and local union-affiliated committees on safety and health (COSH groups) in many states.

The International Federal of Clerical and Technical employees (FICT) included a call for "no VDT monitoring" in its 1984 bargaining guidelines for member white-collar unions. The AFL-CIO at the national and some state levels has adopted a similar position. We collected statements opposing either VDT work monitoring in general or "improper use" of such monitoring by 20 U.S. unions, out of the 32 unions that have addressed VDT issues in the past few years. Several unions that had not issued official statements against work monitoring explained to us that they shared the general labor movement opposition to monitoring but did not have enough members involved in such activity for this to have been made an issue, especially given their more pressing concerns in the 1981-85 period.

Figure 4 lists the 32 unions active on VDT issues, and Figure 5 the 20 unions with anti-monitoring positions.

Figure 4: 32 UNIONS ACTIVE ON VDT ISSUES, 1984

UNIONS
* Automobile, Aerospace, and Agricultural Workers (UAW)
Communication Workers (ACA)
* Communication Workers (CWA)
Electrical, Radio & Machine Workers (UE)
Electrical Workers (IBEW)
Electronic, Electrical, Technical, Salaried and Machine Workers (IUE)
Federal Employees (NFFE)
Food and Commercial Workers (UFCW)
Government Employees (AFGE)
* Government Employees (NAGE)
Graphic Arts Employees (GAIU)
Hospital and Health Care Workers (HHCW)
Hotel and Restaurant Employees (HERE)
Ladies Garment Workers (ILGWU)
Machinists (IAM)
* Newspaper Guild (TNG)
Oil, Chemical, and Atomic Workers (OCAW)
* Office and Professional Employees (OPEU)
* Postal Workers (APWU)
Professional and Technical Engineers (IFPTE)
* Railway, Airlines, and Steamship Clerks (BRAC)
Retail, Wholesale and Department Store Employees (RWDSU)
* Service Employees (SEIU)
* State, County, and Municipal Employees (AFSCME)
Steelworkers (USWA)
Teamsters (IBT)
Telecommunication Workers (TIU)
Telegraph Workers (UTW)
* Treasury Employees (NTEU)
* Typographers (ITU)
University Employees (Clerical and Technical, affiliated with HERE)
Utility Workers (UWUA)

* Most active unions, 1983-84.

+ Totals rounded. Source of figures: Bureau of Labor Statistics, 1980; AFL-CIO estimates; supplementary inquiries at individual unions, 1984.

Figure 5: 20 UNIONS WITH POSITIONS AGAINST VDT WORK MONITORING

UNIONS	Estimated Members +
Automobile, Aerospace, and Agricultural Workers (UAW)	1,350,000
Communication Workers (CWA)	550,000
Electrical Workers (IBEW)	1,000,000
Electronic, Electrical, Technical, Salaried and Machine Workers (IUE)	160,000
Federal Employees (NFFE)	150,000
Government Employees (AFGE)	265,000
Government Employees (NAGE)	300,000
Machinists (IAM)	940,000
Newspaper Guild (TNG)	40,000
Office and Professional Employees (OPEU)	125,000
Postal Workers (APWU)	320,000
Railway, Airlines, and Steamship Clerks (BRAC)	200,000
Service Employees (SEIU)	650,000
State, County, and Municipal Employees (AFSCME)	1,100,000
Steelworkers (USWA)	1,230,000
Teamsters (IBT)	2,000,000
Telecommunication Workers (TIU)	50,000
Treasury Employees (NTEU)	120,000
Typographers (ITU)	80,000
Utility Workers (UWUA)	56,000

Totals rounded. Source of figures: Bureau of Labor Statistics, 1980; AFL-CIO estimates, supplementary inquiries at individual unions, 1984.

Recent cartoons in the union and activist press on work monitoring of VDT operators

!
WORK FASTER OR I'LL REPORT YOU
VDU
Evans

THATS THE THIRD TIME YOU'VE BEEN TO THE CAN THIS MONTH YOU'RE FIRED
UAS. 8.83 MC

A typical statement of the union view appeared in a series on VDTs in the Utility Workers newspaper in late 1983. The union reported that "operators feel that they are 'constantly watched' by the machine....VDT operations provide a much closer tracking system of their job performance than traditional 'paper punching' systems."[100]

Many of the unions active on VDT issues have adopted resolutions or articulated demands involving work monitoring. At its 1982 Skilled Trades Conference, the UAW's resolutions on new technology included this statement: "Technology must not involve undue stress on workers either mentally or physically, and must not be introduced for purposes of computer-time study, monitoring, discipline, or job-pacing. The union must have full access to all information created by computerized data."[101]

In its VDT Guidelines for Federal Employees, the National Association of Government Employees expresses a similar theme: "Stress-inducing features of automated jobs such as machine pacing or computer monitoring should be eliminated."[102]

AFSCME has emphasized in its materials that productivity gains come when employees are able to work more effectively through new technology, not by trying to make employees work harder under tight monitoring:[103]

> **Making Employees Work Harder.** Sometimes new technology cuts costs by making employees bear some of the true costs of providing the goods and services. New machinery may speed up the pace of work, or enable management to monitor work and measure output more closely. As a result, employees work harder under the new system than under the old. They bear the costs of additional stress and fatigue and possibly physical risk but do not receive compensation for the increased intensity of their work. One example of this cost-shifting can be found in some applications of visual display

> terminals (VDTs). Data entry work can be reorganized so that the pace and duration of the operator's time on the machine are increased, and the VDT can be used to closely monitor what work is done. This may lead to increased stress, fatigue, headaches, muscle aches, and eye strain. Ideally, new technology should improve productivity by making the employees involved work more effectively, not harder.

1. Collective Bargaining Positions and Outcomes

No union contract we are aware of includes a prohibition on employer use of machine monitoring. The Communication Workers and Telecommunication Workers, which have made "undue stress" through monitoring a regular bargaining issue in recent years, have only won provisions saying that the company will use service monitoring for training purposes and not for discipline. Union officials we interviewed felt that local supervisors and managers in some locations target older employees and union activists for close monitoring to build up cases against them, then use this either to block upgrade transfers or attempt disciplinary action. The Baltimore case we described earlier illustrates this kind of action, according to the union.

The contract won by the Service Employees from Equitable Life Assurance, for its Syracuse, New York claims approvers, represents, according to union officials, the most important "break-through" thus far in contract provisions on many clerical VDT issues, including work monitoring.[104] The key provisions of this contract which address the privacy aspects of monitoring include:

- Employees will receive full access to information on the productivity system and its operations, including how work units are counted, the weighting formula for time and erros, and how individual pay is calculated.
- Employees will have access to their own individual records, including the raw data sheets.
- If employees believe there is an error in their records, or their pay has been miscalculated, they can file a grievance and this can go all the way up to arbitration, if not settled by the parties.

While management's multi-factor employee evaluation program continues, which includes quantity, quality, attendance, attitude, and communication, attendance will no longer be used as a basis for penalty points and pay. In addition, annual wage increases will be paid, apart from the evaluation program.

Many union publications in late 1984 featured accounts of the Equitable contract provisions on monitoring and said this would become a "union standard." For example, an article in the Allied Industrial Worker in December, 1984 wrote:[105]

> A problem with such monitoring is that it can be done without the worker being aware that he or she is being checked. This raises serious questions about the dignity of workers, their efficiency and their health. While thus far most computer monitoring involves industries such as airlines, banking, insurance and telecommunications, it is likely that such monitoring will develop in many industries as the use of computers becomes more widespread.
>
> The best method for unions to use to attack in this area is contract language. The best example of such language is contained in the new contract between the Service Employees and Equitable Life Assurance Company.

2. Quality of Work Life and Joint-Committee Efforts

In some unions, joint labor-management committees or quality of work life groups have dealt with VDT issues, including ergonomics, stress, health and safety questions, and work monitoring. We discussed in our section on Federal agency practices the incentive pay project of the IRS and National Treasury Employee Union, in which work standards and measurement techniques were worked out in collaboration for this program.

The Communication Workers have described another such example involving Mountain Bell Telephone Company, one that is especially interesting given the long history of telephone company monitoring and of union opposition to how this is maintained.[106]

In Phoenix, Arizona, Mountain Bell and the CWA developed an experimental office where 130 operators handle long distance calls and billings for hotels in the entire Mountain Bell service area. Instead of using Average Work Time standards and traditional Bell-System monitoring of machines and telephone calls, the operators in this office set their own performance standards and supervise their own compliance with them. These standards reflect a quality commitment to assist callers needing special attention as well as efficient handling of peak loads, total productivity goals, etc. CWA President Glenn Watts reports that "these operators are working at higher than average performance levels, completely without supervision." After a year of operation, Watts reports that "the company has measured that unit's profitability at an incredible 45 percent" increase. This proves, Watts says, that "AWT just isn't needed to provide efficient and economical telephone service," and he has called on other telephone companies to follow the Mountain Bell example at other sites. He adds that AT&T's television ads "lately have emphasized the importance of its telephone operators and other workers in providing good service, but we still find in too many areas the company pressuring our people to get rid of callers in order to meet an arbitrary standard of so many seconds per call." Watts hopes to persuade other telephone systems around the country to try the Phoenix experiment.

3. Stress Studies and Filing Worker Compensation Claims

Unions, women's activist groups, and COSH groups have conducted surveys among union members of complaints about VDT working conditions and their health effects. This has been done by the CWA, Postal Workers, AFSCME, 9 to 5, and many others. Among other items, these surveys attempt to document employee experiences of heavy stress because of high production standards that do not reflect the realities of adverse working conditions, system problems, and handling difficult customer problems. Campaigns have been initiated to document that injuries and disabling conditions experienced by VDT operators, and for which worker compensation claims have been filed, had their origins in a combination of bad job design, poor ergonomics, oppressive work monitoring, and supervisor threats based on such monitoring. While there have been well publicized awards of worker compensation to some VDT operators, we are not aware of any statement by a Board or an appeal that has dealt specifically with the monitoring aspect of such worker claim. However, unions and allied groups are clearly focusing on office-worker stress as a major thrust in worker compensation activity, and monitoring will be a key feature of the case against stress-based injuries.

4. Grievances and Arbitration

We have already noted that under federal law and labor relations doctrines covering other employment sectors, the right to measure work is a management prerogative, and has been so held in arbitration. Grievances involving VDT monitoring are therefore focused on particular management use of VDT monitoring. For example, in a recent case involving classified ad takers at the New York *Times*, the local Newspaper Guild chapter argued that management's introduction of a new telecommunication-VDT system that produced a log of time in and out and transactions completed was a "1984 system" that could not be introduced unilaterally. The union argued that this changed the terms and conditions of work in a manner that called for advance consultation with the union, and its agreement, and the union filed an unfair labor charge. A highly emotional walkout occurred, in which ad-takers complained that the system would record "when people went to the toilet," and was a "Big Brother" speed-up and surveillance system that ill-behooved "a great newspaper that is also a champion of freedom of the press and individual liberties." Badges saying "1984 - 6th Floor" appeared in the midst of the protest.[107]

The management answered that the system was a good one whose improved color graphics, better credit data base, and screen "prompts" would help ad-takers improve their productivity and increase their pay; it was never intended to nor would it be used to discipline people for breaks, including toilet breaks. In retrospect, management at the Times conceded that they had not done a good job of preparing ad takers for introduction of the new system, and that they had been unprepared for the violent reaction of the employees. The new system seems to be well accepted now, is producing improved pay for the employees, and has not been used for punitive actions.

Another grievance that went to arbitration in 1984 is the first instance we know of in which computer monitoring itself became the center of a grievance proceeding.[108] The Employment Division of Oregon State's Human Services Department began experiencing in 1982-83 a mysterious loss of documents from its Wang word processing system. When Wang technicians could find no defects in hardware or software, management concluded that one or more word processing operators was changing records to increase her production statistics, presumably to earn more pay or better evaluations.

The Wang system had a software package called the "Machine Statistics System" (MSS). This creates a record with the ID of the operator; the date; the document ID being worked on; the time work started and stopped on that document; what kind of activity was being done; the number of pages created, and the number of keystrokes used for each document. We reproduced a sample page from this Wang system earlier in this report, on page 57. This was used by the agency to collect monthly statistics on the group work unit and each individual operator.

However, they had not used it to check on which operator was using a particular terminal. The agency then wrote a more detailed software program to identify which operator was at a particular terminals. Using this system, management found that all the disappearing documents were originating at one terminal, used by an employee named Donna Stroup. They then monitored all activity at her terminal for a two week period, concluded that she was increasing her keystroke count while she also deleted documents worked on by other employees, thereby decreasing their performance levels.

Management said that cross-checking the printout with that of other operators convinced them that only Ms. Stroup could have tampered with all the documents changed. Also, no tampering took place during a week in the test period when she was on vacation, or the week she was suspended prior to being dismissed. Management said she had a motive to do this because she had been cautioned as a marginal performance earlier; that she knew how to perform the changes that were used to alter the document instructions; and that only she would benefit from the alterations made. Management summed up its position to the arbitrator by saying that the computer was a perfect and credible witness.

The Oregon Public Employees Union, affiliated with the Service Employees International, defended Ms. Stroup in the arbitration. They asserted that she had been performing satisfactorily for a year and had no recent warning about productivity; had no need for more pay or promotions; did not have the skills to do the deletions that were done; and, like other employees, believed that the Wang software could detect any improper acts done by operators. The heart of the union's defense was that there was not a single eye witness and no motive given for Ms. Stroup's alleged action, and that it violated due process concepts to accept the "hearsay evidence" of a computer, which cannot be "cross-examined." The union also argued that, because management had not installed available security software to prevent operators from deleting documents that others worked on, it had not provided the proper system from which to take action against alleged wrongdoing.

After reviewing the printout data, the testimony of the computer experts at the arbitration hearings, and the grievant's case, the arbitrator found the computer evidence to be "reliable" and ruled that its use "does not violate basic, procedural due process..."

> "While both the Union and the Arbitrator pointed out at the hearing that the Employer has no human witness to the charged activity, nevertheless the Employer does have a mechanical witness -- the computer.
>
> "This mechanical witness, without bias, has given a minute-by-minute account of the activity of the grievant on her work station (#32) for the two-week period in question. The computer is a tabla rasa on which the operator writes.
>
> "The Wang software package, the Machine Statistic System ("MSS") silently monitors, 24 hours a day, the activity at each work station in the Employer's clerical support unit, including that of Work Station 32. The MSS, therefore, is the language in which the mechanical witness captured the activity on that work station during the two-week period in question.
>
> "The computer printouts described above are the translated record of what the computer 'saw'. The computer made a record of the events of those two weeks (and of the period July 1, 1983 through July 8, 1983 and during the work week July 25, 1983 through July 29, 1983) as if it were a tape recorder or a videotape, running constantly and focused on work station 32, without human intervention.
>
> "It is from a reading of this mechanical witness's record that the most damaging evidence against the grievant comes."

The union Business Agent who prepared the Stroup defense sees the implications of the arbitration decision as very serious.

> For our members, the big issue here is control. There are many employes out there working with computer systems which are not secured in any way, and which monitor their production. This makes them highly vulnerable to sabotage themselves. There is no question that another employee or supervisor who wished to get rid of someone, could frame a person by manipulating the software. As strong as the computer evidence was in this case, it did not completely rule out this possibility. I think this is something employees should be alerted to. I think it would also be valuable for employees to find out exactly what kind of data is collected on their work through the computer tracking systems.

L. Proposals for Legislative Control of Employer Monitoring

Bills to regulate VDT use have been introduced in 18 states between 1981 and the present. These have been sponsored primarily by labor unions, supported by activist women's groups, local COSH chapters, and some occupational health experts. The bills generally contain three sets of provisions: on health and safety matters, on ergonomic standards, and on work rules for intensive VDT use.

In seven of these state bills, and in the model bills drafted by the Communication Workers and the Newspaper Guild for use in all states, a one-sentence provision appears that would forbid employers to use "individual production monitoring." This has been included in the VDT bills in Ohio, Minnesota, Massachusetts, Pennsylvania, California, Illinois, and New Jersey. The Ohio bill, for example, reads: "No employer shall use a video display terminal to monitor the productivity or measure the performance of an operator on an individual basis."

At committee hearings in 1983-84 on these VDT bills, witnesses supporting them have called for the anti-monitoring provision because of the harmful stress that monitoring is said to create, and the violation to dignity and privacy that "total, Big Brother surveillance" entails. They have said that while some "good" employers do not use monitoring in an oppressive way, the law is needed to reach the many "sweatshop offices" doing this to employees. Employer witnesses have denied that there is the widespread "Big-Brother"-type use of VDT monitoring alleged by union witnesses, insisted that record keeping on employee performance is vital to increasing productivity, and said that any regulation of work standards and measurement should be left by state legislators to labor-management negotiations in unionized firms or to employee relations in the non-union sectors.

None of the VDT regulation bills were passed in 1983-84. The only state government recommendation regarding monitoring so far has come in Connecticut, where the legislature in 1983 had ordered two studies of VDT health and safety aspects to be done, one by the Connecticut Academy of Science and Education, and the other by the State Department of Consumer Protection. The report of the Consumer agency included two recommendations to employers:

- they should not conduct continuous monitoring of individual employee performances through VDT software capacities; and
- monitoring or recording the conversations of VDT customer-service operators should "be discouraged."

Nothing was done with this recommendation by the Connecticut legislature in 1984. There are no clear signs of whether the 1985-86 campaign will go any further than the earlier efforts. Basically, the regulatory campaign has not succeeded because many liberal legislators, and most middle of the road and conservative legislators, have not been convinced that there is a sound health hazard case against the machines per se, based on scientific studies of radiation and other emanations from the VDT.

As for the passage of a law to require ergonomic measures and detailed work rules (including bans or limits on work monitoring), most legislators thus far have felt this was not an appropriate step for state legislators to take at this time, when use of VDTs is still in an early stage, managements are learning what measures need to be taken for comfort and ease of use, and the technology is still changing and developing so rapidly. In addition, witnesses for the major vendors and user groups have warned that the regulations proposed would be extremely expensive for employers to comply with, and most state legislators are not anxious to "drive business away" (especially high-technology users) unless there is clear and convincing evidence that this is necessary to safeguard worker health and well being. Unless this basic situation changes in 1985, passage of the omnibus VDT bills, and of anti-monitoring provisions in particular, does not seem likely.*

VII. A POLICY ANALYSIS OF VDT MONITORING ISSUES

Unlike the use of TV-monitors to watch assembly lines, or of hidden microphones to overhear workers in cafeterias or rest rooms, the collection of operator production statistics generated by system software does not represent an intrusive, unethical, or dehumanizing act per se. Whether the effect of monitoring is intrusive, unethical, or dehumanizing depends on what management does with the data it collects and how its actions are perceived by employees.

In terms of polar positions, we have seen that there are two main models of work standards and measurement, the "union model" and the "Taylor production model." Figure 7 shows the key elements in these presentations, and which of the issues they raise are privacy-related, rather than employee and labor relations based.

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* The CWA persuaded the West Virginia legislature to ban telephone service monitoring (on intra state calls) in 1981, after a well publicized example of what the union called "nasty company behavior" by the local telephone company. A similar bill was vetoed by the governor in California. The West Virginia law does not mention VDTs and was not written with OA technology in mind.

Figure 7. TWO MAIN MODELS IN VDT WORK MONITORING

UNION MODEL	Indiv. Performance Sampling	All Data Available To Employee	Known Procedure For Challenging "Record"	Employee Can Pace Work	Group Production Quotas	Quality/ Problem Factors Recognized	Standard Pay	Individual Shortfall Leads To Training Or Group Discussion
"TAYLOR" PRODUCTION MODEL	Constant Machine Monitoring	Data Not Readily Available	No Procedure For Challenge	Machine Paces Work	Individual Quotas	Quantity/ Speed Standard	Piecework Pay Or Bonus	Individual Shortfall Leads To Discipline

PRIVACY-RELATED ISSUES:	LABOR RELATIONS / EMPLOYEE RELATIONS ISSUES:
"Intrusiveness" And "Subject Access"	"Fair Work," "Fair Pay," "Fair Performance Evaluation"

We do not know of any unionized firm in which the full union model is being used. We saw the Taylor model used in some of the sites we visited, though these were a very small number among the kinds of government and private organizations we were studying.

At the great majority of our sites, about two-thirds, we found that organizations were using significantly modified versions of the Taylor model, as we described in our reports of monitoring use, while about a third were applying what we have called fair work evaluation techniques.

In practice, as we found during our site visits, the difference between employee protests over "Big Brother surveillance" and employee acceptance of work measurement as reasonable depends on whether there is agreement between employers and employees on: (1) the fairness of the standards set; (2) the fairness of the measurement process employed; and (3) the fairness of the way measurements are used in employee evaluation.

Putting the issue this way highlights the fact that both process and substance are involved in how employees will respond to work monitoring issues in the automated office. In terms of process, we saw many examples where genuine involvement of employees -- either through joint labor-management committees in unionized organizations or employee-involvement technqiues in non-union settings — could have spared management painful experiences with employee resistance and protest over work monitoring that is effective and acceptable to employees started with the trusting assumption that almost all employees are ready to put in a fair day's work for a fair day's pay. The challenge they accepted was to involve employees in the application of new office systems technology to the office tasks at hand, and to include work standards, work measurement, and productivity-recognition as matters open for joint discussion.

Recognizing that employee involvement in the initial design, testing, implementation, and continuing adjustment of work monitoring is critical to a successful process, what are the substantive issues that innovative managements seem to be considering in their administration of VDT work, especially in their clerical and customer-service jobs where VDT use is most intensive?

Figure 8 shows the issues that we encountered in our site visits, and which we found about a third of the managements taking into account in developing employee-acceptable productivity programs using machine generated records.

Figure 8. KEY ISSUES AND PROBLEM AREAS IN MONITORING CLERICAL AND CUSTOMER SERVICE WORKERS

KEY ISSUES	PROBLEM ASPECTS
1. FAIRNESS OF WORK STANDARDS	* Do standards fairly reflect the average capacities of the particular work force? * Will they create unhealthy stress for many employees? * Do they take into account recurring system difficulties and other workplace problems? * Do they include quality as well as quantity goals? * Do they represent a "fair day's pay" for a "fair day's work?" * Do employees share in any productivity gains achieved through introduction of new technology?
2. FAIRNESS OF THE MEASUREMENT PROCESS	* Do employees know and understand how the measurements are being done? * Can the measurement system be defeated easily, thereby impairing the morale of those willing to "follow the rules?" * Do employees receive the statistics on their performance directly, and in time to help them manage their work rate? * Is the relation between quality and service measures and work quantity communicated by supervisors when they discuss problems with performance levels with employees? * Do supervisors communicate clearly that they are taking system and workplace problems into account? * Are group rather than individual rates used when particular tasks make such an approach more equitable? * Is there a formal complaint process by which an operator can contest the way work data has been used by the supervisor?
3. FAIRNESS IN APPLYING MEASUREMENTS TO EMPLOYEE EVALUATION	* Are there meaningful recognition programs for these employees? * Is work quantity only one of a well-rounded and objective set of performance criteria used for employee appraisals? * Does the employee get to see and participate in the performance appraisal? * Is there an appeal process from the supervisor's performance appraisal? * Is there a performance-planning system that identifies employee weaknesses in performance and identifies ways to remedy such problems?

The three issues that we have presented in this chart and specific problems involved, were themes we heard in many of our employee interviews, in both union and non-union organizations. They also reflect the concerns that we heard organizations with good employee relations programs or good labor relations beginning to address in 1982-84, during our site visits. And, as we have noted, about a third of those organizations we studied that are using monitoring of some individual clerical operators for evaluative purposes are already following fair work evaluation policies along the lines covered by a positive answer to the "problem aspects" listed in this chart.

From a privacy standpoint, the key elements of fair work evaluation policies are employee knowledge of all monitoring systems used, and their operative elements; employee access to their individual records; and a procedure for contesting the accuracy or fairness of applying records for evaluative purposes. If one adds to that the "non-privacy" but good employee relations aspect of employee involvement in setting fair standards and good employee-manager communication on the planning and implementation of standards, then good employee practice would seem to be present. The parallel between these elements and the Equitable-SEIU contract should be noted.

One judgment we reached in our site visits should be useful to OTA. While managements will no doubt continue to follow divergent approaches to VDT monitoring, for the reasons cited on pages 70-74, there seems to be a growing sense in the business community, and in government also, that appropriate work measurement policies need to be developed if organizations are to achieve the machine efficiencies and the worker commitment which -- together -- can achieve the productivity and commitment goals that employers are seeking at their workplaces. A good presentation of that emerging sense, and one that comes from a mainstream business publication, rather than a reform source, comes from a 1984 article on Dun's Business Month magazine.

WARNINGS FOR MANAGEMENT IN USING COMPUTER MONITORING*

> The negative effects of electronic monitoring are a growing concern. Some experts believe that the problems involved far outweigh the benefits in the long run. And many employees complain that the new technology is both forcing them to function in a more stringent work environment and adding to their stress on the job. "Workers are concerned that they will be pushed beyond reasonable limits to gain productivity," explains Donald Kennedy of Pennsylvania State University's Department of Labor Studies, "and that monitoring and pacing are creating a factory in the office."
>
> The health effects of monitoring and pacing are being studied by the National Institute for Occupational Safety and Health, the research arm of the Occupational Safety and Health Administration. According to NIOSH researcher Michael Smith, studies have shown that monitoring and pacing produce anxiety, depression, irritability and anger and that these reactions can in turn lead to heart-related disorders and psychosomatic illnesses. Physical stress is also a problem. For example, typists who work with computer screens can be physically affected when straining to maintain a pace; they get temporary eye ailments and swollen wrists and arms, which in turn reduce their productivity.
>
> In a study of 2,150 American workers financed by NIOSH to examine the links between pacing and health, it was found that machine-paced assembly line workers are 70%-to-200% more likely to develop heart disease than their supervisors. And workers who are under pressure to produce and have little control over the job are five times more likely to develop heart disease than workers who have the most control over their jobs...
>
> Many academic studies have also demonstrated that quality suffers as a consequence of making a job simple enough to monitor, points out Frederick Herzberg, management professor at the University of Utah's graduate school of business. Herzberg, an eminent authority in the field who has acted as a consultant to AT&T, says the studies show that work simplification makes people act less responsibly and increases errors, job dissatisfaction and even sabotage. "And supervisors are animal trainers rather than managers," he adds.
>
> In large part, the fight over monitoring is a power play in which the strong win. In other words, unionized employees and

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* From "Corporate Big Brother Is Watching You," Dun's Business Month, January, 1984.

professionals such as doctors are more successful than word processors or bank clerks in fending it off...

Monitoring is now a major issue in the bargaining between Equitable Life and the claims processors at its Syracuse, New York, office. While the claims approvers like the wage increases made possible by the computer counting, they want approval over the measuring standards used. They argue that they do not understand the method Equitable uses for scoring and they question its fairness. They also fear that when they reach peak performance, their wage increases will not keep up with inflation.

Local 925, which represents the Equitable workers, recently introduced bills in both the California and Ohio legislatures to regular working conditions for operators of computer display terminals, including provisions to bar individual employee monitoring. Legislation regulating telephone surveillance was enacted in West Virginia in 1981 through the efforts of the Communications Workers of America. The law requires employers to use a beeptone to inform customers and employees they are being monitored. In California, Republican Governor George Deukmejian recently vetoed a similar bill.

But the Big Brother techniques are not all-powerful. "For every system, there is a way of beating it," points out Gerhard Friedrich, a consultant who studies the impact of automation on management organization at Digital Equipment Corp. Most consultants agree that employees can circumvent even the most sophisticated electronic snoops. In one of the most common practices, says Thomas Gilmore of the University of Pennsylvania, employees "rest" by getting headaches when they are forced to work at a pace they think is too fast.

It is also well known that long-distance and directory assistance telephone operators love to outwit AT&T's monitoring system, which supplies a computer-generated AWT (Average Work Time) score on the average number of seconds each operator spends per call. They cheat by hanging up on callers or by transferring them to a supervising operator even when they could handle the inquiry themselves...

/S/ome experts argue that by promoting speed, the measuring of service worker productivity actually defeats its purpose. Cost-benefit analysis, they say, is skewed to measure quantity not quality and short-term but not long-term costs and benefits....

Vice President Carl Thor of the American Productivity Center, a private research organization, further points out that since the routine jobs most often monitored are already automated to increase productivity, not much additional improvement is possible by measuring employee performance. The computer equipment installed to run operations produces the lion's share of any productivity gains, agrees Mitchell Goldstein, office automation consultant at Environetics International, yet the monitoring is frequently mistakenly used to justify the whole expenditure.

Sears, Roebuck & Co., for one, believes the costs in employee morale outweigh the productivity gains in most cases. Therefore, it monitors each call in its catalog sales division for everything except employee performance. According to George Eaton, director of catalog sales, Sears uses individual employee performance reports only to identify personnel that need help and to tally performance on sales promotions. "It really boosts morale to have a contest based on sales per call," he says.

The key to effective monitoring, experts agree, is to convince employees that the measurement system is fair and can't be subverted. American Express, for one, uses outside consultants to make sure its expectations are not unrealistically high or low. "Management must be careful not to push either side /production or quality/ too hard," Sherin says.

American Express also has used quality circles to involve employees in setting quality standards in order to gain their acceptance. Such employee cooperation is critical, says Frederick Herzberg, "because while speed is under the control of the system, quality is under the control of the worker."

With employee support, Carl Thor adds, service industries should be able to avoid the loss of competitiveness suffered by manufacturing companies in sacrificing quality to quantity. Competition in the service industries is primarily domestic, but the competitive danger is the same, he observes. "In the drive toward survival, the companies that put cost savings and quantity before service will be at a disadvantage."

VIII. CONCLUSION

This report has shown that the issue of work monitoring in office automation is a highly charged topic. Sharply conflicting positions have been adopted by employers, unions, interest groups, and social commentators. There is considerable debate over how much VDT monitoring of clerical workers is going on today and whether this is increasing or decreasing. There is debate over whether the monitoring that is being done is mostly being carried out in a Taylor-style high-control fashion, a moderate productivity model, or with new fair work evaluation policies. There is also debate over how to evaluate the additional work stress that VDT operators experience as a result of monitoring, compared to that created by fears over job security, high production demands, poor job design, inadequate ergonomics, and other negative workplace conditions. Our report has presented OTA with empirical and evaluative materials with which to analyze these issues, as they have emerged in the past 4-5 years.

At the policy level, American society faces the classic question of whether this issue is one on which law and regulation is called for, or whether it is best left, for the time being and in the early stages of office automation, to private decision-making and social forces. We have indicated the positions of leading parties on that issue, and the baseline of very limited regulation that marked the pre-OA position of American society.

As far as the privacy dimension of VDT work monitoring is concerned, we have shown that there have been protests over what is regarded as unfairly close, intrusive, and continuous surveillance by "machine monitoring" at the workplace, even though this is not a private location and even though what are normally defined as private acts are not involved. These protests rest on the belief that employees working in locations subject to casual observation and traditional record keeping have not agreed to -- nor should the law, they believe, assume that they ought to accept -- the kind of "total" monitoring that office systems software makes possible. We have shown that this challenge faces an uphill battle against the well-settled arbitration and legal-policy judgment that close employer supervision, even by video camera, does not violate legitimate employee privacy interests.

While this may be the way that arbitrators and judges would decide grievances and lawsuits, absent new legislation, this does not necessarily mean that such would be wise social or public policy. We have shown that whether the *collection* of detailed performance and presence data is regarded by employees as intrusive and unfair is almost always a function of *how it will be used by the employer*. Where employees know what is being done, have access to their own records, and have a process by which they can contest the accuracy or the fairness of specific data used for evaluative decisions, we have seen that the *privacy* dimension of VDT work monitoring has generally been satisfactorily addressed.

This suggests that VDT work monitoring is a "two-faceted" issue. Privacy can be thought of as the *threshold* question. But equally important to employee, employer, and society, is the *employee relations or labor relations dimension*, where questions of harmful stress and its health effects, fair production standards, fair supervisory behavior, and the even more contentious question of "fair pay" are all involved.

Both of these issues promise to be important concerns on the American social agenda for years to come, since they involve the quality of work life for millions of employees moving into high-technology office work, as well as the future productivity of American organizations in an era of heavy pressures for more cost-effective operations.

Footnotes

1. Alan F. Westin, *Privacy and Freedom* (N.Y., 1967).

2. For Taylor's concepts in industry, see Frederick W. Taylor, *Principles and Methods of Scientific Management* (N.Y., Harper and Brothers, 1911). For "Taylorism" applied to office work, see William H. Leffingwell, *Scientific Office Management* (A.W. Shaw Company, New York and Chicago, 1917) and Lee Galloway, *Office Management: Its Principles and Practice* (Ronald Press Co., New York, 1918). Standard works reflecting critical views of "Taylorism" include: C. Wright Mills, *White Collar* (Oxford University Press, New York, 1956); Stanley Aronowitz, *False Promises* (McGraw-Hill, New York, 1973); Harry Braverman, *Labor and Monopoly Capitalism: The Degradation of Work in the Twentieth Century* (Monthly Review Press, New York, 1974); Richard Edwards, *Contested Terrain: The Transformation of the Workplace in the Twentieth Century* (Basic Books, New York, 1979); David Noble, *America By Design* (N.Y., Alfred A. Knopf, 1979); and Dan Clawson, *Bureaucracy and the Labor Process* (N.Y., Monthly Review Press, 1980).

3. George Stelluto, "Report on Incentive Pay in Manufacturing," *Monthly Labor Review*, Vol. 92, No. 7 (July, 1969), pp. 49-53. See George Strauss and Leonard R. Sayles, *Personnel: The Human Problems of Management*, Third Edition, (N.J. 1972), Chapter 27, "Incentives and Performance Standards; pp. 613-635.

4. Mills and Braverman, note 2 *supra*.

5. David Montgomery, *Workers Control in America: Studies in the History of Work, Technology, and Labor Struggles* (N.Y., Cambridge University Press, 1979).

6. Donald Kennedy, Charles Craypo and Mary Lehman, *Labor and Technology: Union Response to Changing Environments* (Phila.: Pennsylvania State University, 1982).

7. Sumner Slichter, James J. Healy, and Robert Livernash, *The Impact of Collective Bargaining on Management* (Wash.: Brookings, 1960), Chapter 12, "Union Policies Toward Technological Change;" Markley Roberts, "The Impact of Technology on Union Organizing and Collective Bargaining," in Kennedy et. al, note 6 *supra*.

8. *Ibid*.

9. Strauss and Bayles, note 3 *supra*.

10. Frank Elkouri and Edna Asper Elkouri, *How Arbitration Works* (Wash.; Bureau of National Affairs, 3d. edition, 1973), Chapter 13, "Management Rights."

11. See Barbara Garson, *All The Livelong Day: The Meaning and Demeaning of Routine Work* (N.Y., Doubleday, 1975); Louise Kapp Howe, *Pink Collar Workers* (N.Y., G.P. Putnam's Sons, 1977); Jean Tepperman, *Not Servants, Not Machines* (Boston: Beacon Press, 1976).

12. Letter of H.W. William Caming, Attorney, American Telephone & Telegraph Company, September 8, 1975, printed in NWC Staff Studies and Surveys, National Commission for the Review of Federal and State Laws Relating to Wiretapping and Electronic Surveillance, Washington, D.C., 1976, pp. 500-514.

13. In addition to Caming, note 11 *supra*, see: Re Investigation of Offering Monitoring Equipment by Telephone Companies, 70 PUR 3d 498 (1967), California; and notes to Section V, *infra*, on Georgia, West Virginia, and New Jersey State Public Utility Commission proceedings.

14. Caming, note 11 *supra*.

15. *Ibid*.

16. *Id*.

17. *Id*.

18. Letter of B.F. McLeod, Vice President, Communications, Pan American World Airways, August 18, 1974, in NWC Staff Studies and Surveys, note 12 *supra*., pp. 527-529, 533.

19. See the files of the Connecticut Workers and Technology Oral History Project, University of Connecticut, Storrs, Conn, 1981.

20. Testimony of IAM by George J. Poulin, Workplace Privacy Hearings, U.S. Department of Labor, January 28, 1980.

21. Commonwealth Edison Company, Grievance No. 27-235, May 21, 1967.

22. Boston Herald Traveler Corporation, Case No. 1130-0291-68, arb. award, November 12, 1969.

23. FMC Corporation, 46 L.A. 335 (1966). An individual's right of privacy held to protect him against publication of *private* statements or action, but employee's actions at work are not private actions.

24. See Caproco, Inc. and Upholsterers, Local 25, 56 L.A. 65; and Cooper Carton Corporation and Printing Pressmen, Local 415, 61 L.A. 697.

25. Eico, Inc., 44 L.A. 563 (1965). For a general discussion of arbitration rulings on monitoring, see Elkouri and Elkouri, *op.cit*. note 10, pp. 283-289 and 729-733.

26. Testimony of APWU, Daniel B. Jordan, Workplace Privacy Hearings, *op.cit*., note 20, January 29, 1980.

27. See Ken Rubin, "Electronic Monitoring in the Workplace", Perception, March-April, 1983, pp. 25-27.

28. For decisions involving a variety of challenged techniques alleged to be improper surveillance of protected union activities, see *C. and J. Manufacturing Co.*, 238 NLRB 138 (1977); *N.L.R.B.v. Medley Distilling Co*. 483 Fed. 2d. 374 (1971); and *Steelworkers v. N.L.R.B.*, 405 Fed. 2d. 1373 (1968).

29. See the discussion of service monitoring under Title III in *Electronic Surveillance*: *Report of the National Commission for the Review of Federal and State Laws Relating to Wiretapping and Electronic Surveillance*, Washington, D.C., 1974, pp. 28-29.

30. See Testimony of CWA, James Webb, *Workplace Privacy Hearings*, *op.cit*. , note 20, January 29, 1980, and *NWC Staff Studies and Surveys*, *op.cit*., note 12, "Service Quality Monitoring," pp. 496-499.

31. Jim Montgomery, "Concerns Eavesdrop on Employee's Phone Calls; Firms Defend Move, But Workers Are Angry," *Wall Street Journal*, March 12, 1974.

32. *Ibid*.

33. See Alan F. Westin and Michael A. Baker, *Databanks in A Free Society* (N.Y., Quadrangle, 1972), Appendix B.

34. "Concerns Eavesdrop...," note 31 *supra*; Ronald Kessler, "A.T.&T. Monitors Some Phone Calls," Washington *Post*, August 25, 1974; Spencer Rich, "U.S. Agencies Defend Their Monitoring of Citizens' Calls, Washington *Post*, October 18, 1978; "Customer Calls Were Tape Recorded to Study Employees, Power Firm Says," Miami-*Herald*, February 5, 1978, Richard H. Meeker, "Local Businesses Eavesdrop (on) Calls," Willamette (Oregon) *Week*, May 9, 1977.

35. See IAM Testimony, *Workplace Privacy Hearings*, *op.cit*. note 20; also Testimony of United Electrical, Radio and Machine Workers, Hugh Harley, *Ibid*, February 19, 1980. See also Braverman, Edwards, and Noble, note 2 *supra*.

36. Fred K. Foulkes, *Personnel Policies in Large Nonunion Firms*, (Englewood Cliffs, N.J., Prentice-Hall, 1980)

37. *Comfort and Productivity in the Office of the 80's*, The Steelcase National Study of Office Environments, No. II, Conducted by Louis Harris and Associates, report published 1980.

38. *The Dimensions of Privacy: A National Opinion Research Survey of Attitudes Toward Privacy*, Conducted for Sentry Insurance by Louis Harris and Associates and Dr. Alan F. Westin, 1979.

39. *Ibid*. Page 33.

40. *Ibid*. Page 35.

41. Judith Gregory and Karen Nussbaum, Race Against Time: Automation of the Office (Cleveland: Working Women, National Association of Office Workers, 1980).

42. All of these unions testified at the Carter Administration's Workplace Privacy Hearings, note 20 supra.

43. Pressures At The Workplace, Hearings before the Subcommitte on ________________ , House Education and Labor Committee,_____ Congress,____Session, 1979.

44. George Kessler, CWA, Changing Competitive and Technology Environments in Telecommunications," in Kennedy, Craypo and Lehman, note 6 supra, page 72.

45. In addition to rulings in note 24, see Hobart Manufacturing Co. and Electrical Workers, IVE, 62 L.A. 1285 and Colonial Baking Co. and Bakery and Confectionery Workers, 62 L.A. 586.

46. Casting Engineers and Electrical Workers, UE, Local 1114, 76 L.A. 939.

47. Electronic Surveillance, note 29 supra. pp. 28-29.

48. See the Washington Post, October 18, 1978, note 34 supra.; David H. Rothman, "Big Brother May Be Listening In," Washington Post, June 3, 1979.

49. Washington Post, October 18, 1978, note 34 supra.

50. "GSA Acts to Block Listening Devices on U.S. Agency Phones," Washington Post, July 6, 1978; Washington Post, October 18, 1978.

51. New Jersey, Wisconsin, Massachusetts.

52. Report of New Jersey Public Utility Commission, 1977, Trenton, N.J.

53. Quoted in Miami Herald, February 5, 1978, note 34 supra.

54. The Road After 1984: The Impact of Technology on Society, A Study by Louis Harris and Associates for Southern New England Telephone, 1983.

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57. "Work Monitoring," ABC-TV Nightly News, May 29, 1984.

58. See the *Selected Bibliography* for sample items.

59. *Ibid*.

60. *Ibid*.

61. Provided by Glenn P. Haney, Director, Office of Information Resources Management, U.S. Department of Agriculture, Letter to Alan F. Westin, November 9, 1984.

62. See the account of this case in Section VI K4 of this report.

63. "When Machines Monitor Work," *World of Work Report*, Work in America Institute, Vol. 9, No.5, 1984.

64. Telephone interview by Nancy Warren with Dr. Michael Smith, November 8, 1984.

65. See "Campaign on VDT Risks - Analysis of VDT Operator Questionnaire of VDT Hotline Callers", 9 to 5, the National Association of Working Women, February, 1984.

66. See "National Survey on Women and Stress," prepared by 9 to 5, the National Association of Working Women, 1984. It appeared in *Working Women*, R. Chris Knight, "Can Stress Make You Sick?", April, 1984, *Ms*., "Stress On Your Job - A Major National Survey," April, 1984, and *Essence*, Julianne Malveaux, Phd., "Black Women and Stress," April, 1984.

67. See "The 9 to 5 National Survey on Women and Stress - OD: Addendum" 9 to 5, the National Association of Working Women, 1984.

68. Peter Perl, "Rising Performance Standards Keep Some in Agency on Edge," Washington *Post*, September 3, 1984.

69. *Office Safety*, AFGE, 1983.

70. "What Can You Do," NAGE, July, 1983.

71. Interviews by Nancy Warren with staff of AFGE, NAGE and NFFE, 1984.

72. Interviews by Heather Schweder with Czarina Palting and Paulette Van Norman, U.S. Office of Personnel Management, October, 1984.

73. Interviews by Alan F. Westin with Mary Anderson and Jack Connors, U.S. General Services Administration, December 7, 1984.

74. Interview by Heather Schweder with Joseph Young, Chief, Data Processing Division, U.S. Department of Transportation, October 25, 1984.

75. Letter to Alan F. Westin from Edward J. Minbel, Managing Director, Federal Communications Commission, November 2, 1984.

76. Letter to Alan F. Westin from D. K. Stephens, Grants and Information Management Officer, National Endowment for the Arts, October 30, 1984.

77. Letter to Alan F. Westin from Paul G. Swope, Director, Office of Computer Sciences, U.S. Small Business Administration, November 6, 1984.

78, Letter to Alan F. Westin from D. E. Lemmon, Director of Management Policy and Systems, U.S. Department of Labor, November 6, 1984.

79. Interview by Alan F. Westin with Steve Matthews, Federal Reserve Board, November 29, 1984.

80. Enclosed with letter to Alan F. Westin from Glenn P. Haney, Director, Office of Information Resouces Managementm U.S. Department of Agriculture, November 9, 1984.

81. Letter to Alan F. Westin from William M. Hunt, Associate Director for Administration, U.S. Office of Personnel Administration, December 6, 1984.

82. Interviews by Nancy Warren with NFFE, AFGE and NAGE staff members, November-December, 1984.

83. Peter Perl, cited in note 68 _supra_.

84. Note 82 _supra_.

85. _Ibid_.

86. Peter Perl, cited in note 68 _supra_.

87. Interview by Nancy Warren with APWU official, October 31, 1984.

88. Statement of William H. Burrus, Executive Vice President, General Postal Workers Union, before the Hon. Parren J. Mitchell, Baltimore, MD, February 14, 1984.

89. Interview by Alan F. Westin with Peter Jones, Director, Justice Employee Data Service, U.S. Department of Justice, December 7, 1984.

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91. Interview by Alan F. Westin with Ed Moriarity, Chief of Management and Resources Branch, IRS, October 3 and 4, November 11, and December 3, 1984.

92. Union interviews were held by Alan F. Westin with staff at National Treasury Employees Union, June, 1984.

93. "Corporate Big Brother is Watching You," *Dun's Business Month*, January, 1984.

94. "AWT - A Real Stress Point," CWA *News*, April, 1983.

95. See the account in Peter Perl, note 68 *supra*.

96. Testimony of Rebecca Alford, Service Employee International Union and 9 to 5, the National Association for Working Women, before the Hon.Joseph Gaydos, Subcommittee on Health and Safety, House Education and Labor Committe, Hearings on Video Display Terminals, February 28, 1984.

97. Quote on MacNeil/Lehrer program, note 56 *supra*.

98. This account comes from a class report written by the loan officer in a business school management course. To preserve confidentiality to the fullest extent, no further identification is made here.

99. Craig Brod, *Technostress* (New York, 1984), page 64.

100. (Citation to be supplied).

101. (Citation to be supplied).

102. (Citation to be supplied).

103. (Citation to be supplied).

104. "District 925 of SEIU Ratifies First Contract With Equitable," Bureau of National Affairs, *White Collar Report*, November 14, 1984, pp. 593-594.

105. *Allied Industrial Worker*, December, 1984, page 10.

106. (Citation to be supplied).

107. *Union Times*, New York Times Unit, Newspaper Guild of New York, *Vol. 19, No. 23*, July 18, 1983.

108. Documents in this case were furnished to us by Katherine A. Black, Business Agent, Oregon Public Employee Union, Local 503, SEIU, in March and June of 1984. We express our appreciation to Ms. Black for this assistance.

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APPENDIX

Thirteen

December 28, 1983
Transcript #2153

WNET/Thirteen: 356 West 58th Street, New York, N.Y. 10019
Transcripts: MacNeil/Lehrer NewsHour, Box 345, New York, N.Y. 10101
Press contact: Roz Boyle (212) 560-3016

The MacNeil/Lehrer NEWS HOUR

Pentagon Marine Report
Big Brother in the Workplace

In New York

ROBERT MacNEIL .... Executive Editor
CHARLAYNE HUNTER-GAULT .... Correspondent

In Washington

JUDY WOODRUFF .... Correspondent

Guests

In Washington

Sen. JOHN WARNER .... Republican, Virginia

In New York

Vice Adm. THOR HANSON .... Former Director, Joint Chiefs of Staff
JAMES O'BRIEN .... Productivity Expert

In Boston

HARLEY SHAIKEN ...... Massachusetts Institute of Technology

Reports from NewsHour Correspondents

GERARD WILLIAMS (Visnews), in Beirut

LESTER M. CRYSTAL .... Executive Producer

Funding for this program has been provided by this station and other public television stations and by grants from American Telephone & Telegraph Company and the Corporation for Public Broadcasting.

A co-production of MacNeil-Lehrer-Gannett Productions, WNET and WETA Show #8900

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11-21 #2126 AT&T Stocks/Manville
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11-23 #2128 Soviet Walkout/Pennsylvania Welfare
11-24 #2129 Eden Pastora/American Shoes
11-25 #2130 Counterdeployment/Thinking Computers
11-28 #2131 Shopping/Space Lab
11-29 #2132 Greyhound/Title IX
11-30 #2133 New Israeli Ties/Salvador Guerrillas
12-1 #2134 Feldstein Flap
12-2 #2135 Mideast/Caribbean/Trailways
12-5 #2136 Moscow Press/Price Fixing
12-6 #2137 Quotas/Sikhs/Nepal
12-7 #2138 Space Budget/Union Busting
12-8 #2139 Paul Nitze/Third World Children
12-9 #2140 Eastern's Contract/Natural Gas
12-12 #2141 Mideast Policy?/Federal Deficits
12-13 #2142 Drunk Driving/Melvin Van Peebles
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12-15 #2144 PLO Status/Texas Desegregation
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12-19 #2146 PLO Evacuation/Deregulated Safety
12-20 #2147 Bomb Report/Democrat Rules Dispute
12-21 #2148 Doomsday/Salvador/GNP
12-22 #2149 U.N. Troops for Beirut?/GM-Toyota Deal
12-23 #2150 Pentagon Marine Inquiry/Jeane Kirkpatrick
12-26 #2151 Is Andropov In Power?/Miro/Philip Johnson
12-27 #2152 U.S. Steel Closures/Sendak's Nutcracker

Subscriptions: $22[illegible] year. ([illegible] per transcript)

MacNEIL/LEHRER NEWSHOUR
Box 345
New York, N.Y. 10101

Transcript #2153

The Ed Fund for Ind.Right
475 Riverside Dr #820
New York NY 10115

WOODRUFF: O'Neill also said that some of the crop loss may be made up by imports of orange juice from Brazil. Robin?

MacNEIL: Our next major topic tonight is a business story. One of the most telling themes in George Orwell's novel, *1984*, which we're hearing a lot about just now, was the image of Big Brother watching over people's lives. For a growing number of workers in this country, that fictional concept has a ring of truth. Charlayne Hunter Gault has more. Charlayne?

CHARLAYNE HUNTER-GAULT: The workers who are most worried about Big Brother are those employed in the insurance, banking and credit card industries. In those areas, office managers are using computers to monitor worker performance. These workers say the use of computers is turning many offices into what they call electronic sweatshops. We recently visited a number of workers to hear their stories.

EVELYN MacLEAN, classified department, New York Times: Now management has you where they want you; they can have a complete time-study on you every second of the day that you are in that office. And they have these printouts, and they know when something is being done the way they want it or they don't. And the individual doesn't mean a thing.

AVA WILLIAMS, clerical worker, Equitable Life Assurance Society: They're just like a dictator, someone standing over you all the time, the computer. They know what time you log on, they know when you log off, they know how long if you stop to take a bathroom break, they know how long you were gone. The machine tells it all.

WOMAN: It's a computer-generated system. I think they sat on a computer and had the computer come up with a system, and that's the only thing I can think of. I can't think of any person, any human person in their right mind who could come up with something like this.

HUNTER-GAULT *[voice-over]*: What all these office workers are protesting is the use of computers to monitor their work. Computers now measure and pace the amount of work done by clerical employees in many industries.

TELEPHONE OPERATOR: Okay. I suggest you call your professional relations representative. Where are you located?

HUNTER-GAULT *[voice-over]*: They also monitor the speed and performance of telephone operators, telling managers how many calls they handled and how much time they spent on each call. One company that uses computer monitoring is Blue Cross-Blue Shield of Massachusetts. A year and a half ago the company moved into this new office in Plymouth, a suburb of Boston. Here, two shifts of claims processors work at video display terminals. The building is specially wired to a mainframe computer in downtown Boston. The lighting is indirect to cut down glare on computer screens and the atmosphere is low key. It's all designed for maximum productivity, according to Blue Shield executive vice president Philip Gillette.

PHILIP GILLETTE, Blue Shield of Massachusetts: We're measuring in the claims area the actual amount of work that a person does, the actual amount of claims that they are producing. Now, there are various types of claim types, and we apply standards, as I mentioned, and we employ industrial engineering standards. I mean they're just not off the top of somebody's head. They're done through MTM methods, time and motion standards, and it's very scientific.

HUNTER-GAULT *[voice-over]*: The company even has an industrial engineer, or time-study man, on staff. Gil Charest analyzes every motion involved in the job and then sets a time standard for each activity.

GIL CHAREST, Blue Shield of Massachusetts: The way you analyze a keystroke is to look at a keystroke in terms of three basic motions: the reach motion, which is the reaching of the finger to the particular key; a contact of that key — in this case a contact grasp, which is just making contact with the key; and a move, which is pushing that key down. Reach, grasp, move. Reach, grasp, move. Okay, the amount of time allowed for that particular task is 4.5 TMUs, which off the top of my head is roughly equivalent to a fifth or one eighth of a second.

HUNTER-GAULT *[voice-over]*: The claims processors in Plymouth are all women and all part timers. They work six hours a day with one 15 minute break. Their pay depends on their output. The computer keeps track of the amount of claims they process. It also compares each worker's performance against a standard. If a worker exceeds the standard, her paycheck is increased. But if she falls short, her pay goes down.

KARL SCOTTRON, office manager, Blue Shield of Massachusetts: Our supervisors can on a daily basis inquire on an individual or on a group by going into the particular file to inquire on how productive an individual might be. Also, as I mentioned earlier, we have a weekly report. Basically it tells them, it gives them the time of day, the date, the, again, number of claims by type of claim, the length of time it has taken them to key those particular claims, the amount of time it should have taken them if they were at 100% efficiency. And it gives them an overall summary in terms of their performance.

Blue Shield WORKER: I think it gives you the opportunity to push ahead and knowing that you're going to get something for it. If the incentive system isn't there and you're a hard worker, sometimes it takes a very long time to be noticed. This way here it gives us a chance to work hard and make the money for what we're doing.

2nd WORKER: I think you get used to it. I think in the beginning it's hard. I've worked with machines, so it doesn't bother me maybe as much as other people in the beginning. But I think you don't think about it after a while.

1st WORKER: It gives us an opportunity, though, to see how we're doing on a daily basis by being monitored, and whether we need to push a little bit harder, or what we really need to do. I think it helps us to know on a daily basis how we're doing. So it doesn't bother me any longer.

REPORTER: But it did. Could you tell me about—

1st WORKER: Well, originally because I never worked in a job that I was on a productivity basis, and so at first you just have to get used to it.

HUNTER-GAULT *[voice-over]*: Not all workers are accepting so easily the introduction of computer monitoring. There's been an outbreak of protests from workers at *The New York Times*.

RICHARD BURGER, classified department, New York Times: You know, you can tell people that they'll have to get used to manacles or chains or other discomforts and things that are wrong. You can always tell them to get used to it, but does it justify them? And isn't it a scary indication of the times when management can say something like that to me? "You're the employee so you'll just have to get used to what we impose upon you."

HUNTER-GAULT *[voice-over]*: At the *Times*, ad takers in the classified department have gone to the National Labor Relations Board, complaining of a new telephone system that watches over their every move.

Ms. MacLEAN: Ad takers have always been under surveillance. They've always been listened in on. The video display terminal prints out a report at the end of the night showing how many lines a person does, how many inserts, etcetera. Anything anybody would ever want to know about an ad taker is on that printout. And we thought that was enough of any kind of surveillance for anybody to have. When in May they came along with the new phone system, if for any reason you have to get up from your desk to leave it, whatever it might be — to get a drink of water, to go up to the front of the room to look at a dictionary — you have to also push this button which is ticking away and recording how many minutes you're away from your desk. If you have to go to the bathroom, you have to push this button, and all of this is being timed.

Mr. BURGER: Big Brother is really alive and well in the classified advertising department of *The New York Times*.

HUNTER-GAULT *[voice-over]*: One of the leading critics of computer monitoring is Karen Nussbaum. She heads 9 to 5, the National Association of Working Women

KAREN NUSSBAUM, president, 9 to 5: We found that monitoring is counterproductive, that it doesn't improve the work of office workers; all it does is increase the control over office workers. Workers at the Equitable Life Assurance Society in the Syracuse branch office decided to unionize with District 9 to 5 just a couple of years ago because of lots of the problems that arise from automated offices. These workers are monitored, they have high rates of stress, a lot of people suffer from hypertension, headaches, migraines. In fact, it was an insurance company, Blue Shield in San Francisco, that was the site of an important study by the National Institute of Occupational Safety and Health, which found that clericals who work full time on VDTs had the highest rate of stress ever recorded, higher even than air traffic controllers.

HUNTER-GAULT *[voice-over]*: We asked workers how this stress affects them.

Ms. WILLIAMS: I'd say headaches, nausea, gastritis.

2nd WOMAN: Back aches.

Ms. WILLIAMS: Yeah, head— oh, muscle pain. Just from sitting in this position all day long. I mean, you can get up and walk around, but it's not— just go to the bathroom and come back? Doesn't do it all the time. Eye problems, strain on your eyes, nervous stomachs. Because if you're not— "Oh, I did a bad day, I didn't make it today, I'm not getting to get, you know, my work in; it's going to be rotten for the whole week." So that means I'm going to drop a step. A lot of people are nervous.

Ms. NUSSBAUM: If we institute these kinds of working conditions that are based on policing workers, that are based on speedup, that are based on piece rates, this can only lead to an epidemic of stress-related diseases. It leads me to think that in fact the computer age will be characterized by stress as the major occupational disease, much in the way that the industrial age was characterized by loss of limb or back strain. These aren't conditions that I think any sane society would deliberately create, yet that's what we're doing right now for 20 million office workers.

HUNTER GAULT: Both the *New York Times* and the Equitable Life Assurance Society declined to be interviewed on camera for this report. In an off-camera interview, officers at Equitable Life said that by and large "workers like the objectivity" of the computer monitoring system, and that "any stress is self-imposed." Robin?

MacNEIL: To give us management's perspective we have a man who helps employers fix the standards they use to measure workers' performance. He's James O'Brien, executive director of the MTM Association, a New Jersey based nonprofit group which helps companies improve productivity. First of all, what's your general reaction to the complaints you've just heard in that report?

JAMES O'BRIEN: Well, basically the opinion offered by the Blue Shield group to me seems to be the one that is most reliable in terms of the fact that it's a successful program of work measurement. Work measurement in many cases being blamed for the lack of proper management, proper management institution of work measurement techniques. Basically—

MacNEIL: Is that saying the techniques in themselves aren't bad, it's the way management uses them?

Mr. O'BRIEN: Correct. Exactly right. We feel that work measurement in today, especially a result of the White House Conference on Productivity chaired by President Reagan and attended by many of his Cabinet people, pointed up that productivity improvement must continue for our society to continue to be competitive in the international market. And how can we continue to get productivity improvement? Well, we have to have a way of measuring productivity, and therefore what we feel that productivity does do, or work measurement does, is to give the individual an attainable goal. It also, if properly used, gives the individual a means to be trained in what is the correct way to do something and to see that they can be convinced that the particular technique is one that is working smarter, not harder. And also, and thirdly, which most people seem to forget, that actually work measurement is a measure of management's effectiveness, and their effectiveness in organizing the work and the employee attitude. Work measurement by itself does not increase productivity.

MacNEIL: Now, what about the feeling of these workers that Big Brother is watching them that every moment is being policed? If they spend too long going to the bathroom or walking down to the other end of the room to look at a dictionary, they're going to be penalized somehow, and the stress they feel from all that?

Mr. O'BRIEN: All right. Again I feel that that is a problem within the way that the work measurement system has probably been installed. We believe very strongly that work measurement techniques should be fully explained to the individual employees upon which they're going to be imposed; we feel that the employees should have input, and we feel that there should be reasonable allowances. There's nobody reasonably should say that a person should stay at a workplace without moving, without being able to go to personal relief or whatever. Work measurement basically tells the individual company or industrial engineer what the time should be taken to do a given task. Now, the fact that there may be allowances within that task should be considered. Employee input should be considered. A good work measurement program is one in which is installed, signed off by the supervisor and signed off by the employee themselves that can agree upon the content of that particular task.

MacNEIL: Hasn't traditionally one of the appeals of office work, clerical work, been that your time was a little bit your own? You could move around and accomplish your work in your own time, whereas the blue-collar assembly line worker was tied to the movements of the assembly line. Isn't this making office workers much more like the blue-collar assembly line worker?

Mr. O'BRIEN: Well, there are certain tasks in the so-called white- or pink-collar area that are in fact very job-situated— job-position oriented. The particular pictures you saw, where a person's working—

MacNEIL: You've got to stay at the machine.

Mr. O'BRIEN: Yeah, in particular. Those kind of tasks probably have the best advantage towards classical work measurement, the detailed work measurement, the one individual was saying about from Blue Shield. However, again, there is nothing wrong with job enrichment along with work measurement. Nobody— if the management sees fit, should say that a person could work a few hours at this particular terminal and then take on another task in another position, in another part of the office. So it is really management's prerogative that determines whether the task is going to be continuous and routine and without a break, and it's not work measurement that's causing that problem.

MacNEIL: Well, thank you; we'll come back. Charlayne?

HUNTER-GAULT: There are those who disagree with Mr. O'Brien. Among them is Harley Shaiken, a specialist in labor and technology at the Massachusetts Institute of Technology. He is with us tonight in the studios of public television station WGBH in Boston. Mr. Shaiken, what's your main objection to using computers to monitor workers?

HARLEY SHAIKEN: Well, I think there are two very serious objections. The first is that it degrades the quality of life on the job. It seeks to increase productivity by demeaning what workers do. And the second objection is really kind of ironic, in that efficiency in many cases does not increase; actually it's decreased in quite a number of different instances.

HUNTER-GAULT: How do you mean demeaning what workers do?

Mr. SHAIKEN: The idea that someone is watching you, that someone is monitoring what you're doing each minute, each second of the workday is really quite demeaning, and a number of studies have shown, as well as the interviews with the workers on the show tonight, that people respond with a great deal of stress to that kind of a situation.

HUNTER-GAULT: But haven't workers always been monitored one way or another? I mean what's so different about this computer monitoring that hasn't gone on in one way or another before?

Mr. SHAIKEN: I think there's a number of very fundamental differences. For one thing the monitoring is far more pervasive and intense. In the past when we talked about scientific management, the 19th century philosophy of Frederick W. Taylor that sought to break skilled work into its smallest components and to time-study each aspect of it, it required someone physically standing behind the worker with a stopwatch. But now each worker, effectively, has his own or her own time study person. The time-study is completely pervasive. So in a very real sense, what we're talking about now is electronic Taylorism, taking the ideas of Frederick W. Taylor and putting them into the machine. And I think rather than this being a result of computerization, it's really a very serious misuse of computer technology. And what results isn't simply an increase in efficiency — often, as I said, that may go down — but a great deal of stress and strain on those people who are studied in this way.

HUNTER-GAULT: But when we talked to the people at Equitable, they said that any of the stress— that more than likely, the stress that the workers are experiencing is really self-imposed. Do you disagree with that?

Mr. SHAIKEN: Oh, I think that really misstates the situation quite clearly. And any number of studies that have been done, both in the United States and Europe, point to very different conclusions. One study that was mentioned earlier by the National Institute of Occupational Safety and Health showed quite clearly that using work pacing does increase stress. Other studies done in Sweden and Columbia University point to machine pacing as a very significant contributor to stress, and also stress leading to all kinds of diseases and discomfort in the workplace.

HUNTER-GAULT: But what about the Blue Shield worker we just heard who said that, you know, once she got adjusted to the system, she was really quite pleased with it; it just took a little while to get adjusted to it?

Mr. SHAIKEN: I think that really overall that that's not the response of most workers that have been shown in any number of independent studies. What's quite serious about this kind of a situation is just how pervasive and long-lasting the time-study is. And in that sense what we're talking about really isn't work measurement, it's work control. It's using the measurement to pace what workers do. If the real issue were simply the gathering of information, then at the end of each workday or even at the end of each workweek, a worker could enter into a computer terminal what that worker had done. But what we're seeing here isn't simply measuring work; it's using electronic technology to pace work. In effect it's an electronic assembly line.

HUNTER-GAULT: But Mr. O'Brien says it's really used to measure management's effectiveness.

Mr. SHAIKEN: I think it really misstates what effectiveness is all about. In a work situation in the office, is effectiveness simply how many times you hit a keyboard, or is it the quality of the service that's being presented? In an office, for example, if you type twice as many memos, are you twice as productive? And in an insurance company the quality of the service that's presented to the public often is not what's being measured, and often that's the hidden cost of using these kinds of systems. Another hidden cost is the fact that innovation often suffers. If you put people in an electronic straitjacket, then they're not going to go outside of that straitjacket to seek to improve the quality of the service that's being presented.

HUNTER-GAULT: All right, thank you. Robin?

MacNEIL: Mr. O'Brien, you just heard your baby described as a serious misuse of computer technology which induces— which degrades the workers and demeans what they do.

Mr. O'BRIEN: Well, I would have to take exception, respectfully, that the data collection technique is just one of many techniques that can be used to gather data. You can measure documents out versus documents in; you could measure— certainly quality should be taken into consideration. And I think the fact that a computer, today's technology permits the data collection in an easier manner — and that's the key to it — why should an industrial engineer or should anybody have to sit there and count and count and count when we have other technological advances that allow a person to sign in and sign out.

MacNEIL: Let's ask Mr. Shaiken that. Why shouldn't you use the technology, Mr. Shaiken, to do what people had to do before?

Mr. SHAIKEN: Well, this is really taking 19th century forms of work organization and using a 20th century technology to carry them out. I think the real issue isn't measuring the amount of work that's done; it's using the technology to control each minute of a worker's time. And in that sense it takes the theme of what went on before and gives it a very frightening new dimension.

MacNEIL: Well, let's go back to Mr. O'Brien on that. He says it isn't to measure the quantity, it's to control the worker.

Mr. O'BRIEN: Well, again, I think that is taking a very narrow viewpoint. I don't think that the people are controlling the worker. If work measurement and the overall industrial relations technique used in conjunction with work measurement is correctly employed, we're not asking to control the worker as described — taking one little reach and one little push of a button. I don't think that that is exactly the point that's being tried to be brought out. What I think they're trying to say is, "Look, here's an attainable goal. Now, we can have gain sharing as a result of attaining that goal, we can have a way to fully instruct you on how to do the job, and we can assist you in doing that job." To say that it's machine paced or that it's a sweatshop is an oversimplification. Frederick W. Taylor, the father of scientific management, happened to be a graduate of the same school that I came from. And his whole scientific management was not designed to be used as it was used subsequently, and he died a very frustrated man. Scientific management was brought in to enhance the worker's opportunity to earn, to give a better environment. We also feel that work measurement, correctly used, designed correctly, actually makes people attain their job in an easier manner.

MacNEIL: Several times, Mr. Shaiken, Mr. O'Brien has emphasized correctly used, correctly introduced. What do you think of the possibility that a lot of the unhappiness with it may be because it has not been correctly used?

Mr. SHAIKEN: No. I think the unhappiness is precisely in that it's being used as designed. That it really, it's not a question of the technology; it's a question of power masquerading as technology. These are systems that are designed to control what a worker does. They're designed to measure things as they happen. This is no more simply a question of measurement than tapping someone's telephone is a question of communication. It's really using electronic monitoring to pace how work takes place. And in that I think it's a very short-sighted approach. The appeal is that you can quantify everything, you can see how many keystrokes, you can see when someone's away from the machine. But in quantifying, a certain kind of very, very unfortunate pressure is exerted that destroys very often the quality and the innovation that workers can contribute in a more free type of work environment.

MacNEIL: What about that, Mr. O'Brien?

Mr. O'BRIEN: Well, again I think that Mr. Shaiken is concentrating very, very strongly on the data collection technique, and saying that because of the electronic nature of it, it permits the minute-to-minute monitoring. I think if you talk to Blue Shield of Michigan [*sic*] you will find out that that is not the exact way it's used. It is not used for minute-to-minute monitoring; it is used as a data collector, one form. They could probably have easily taken it by measuring documents.

MacNEIL: But what about the study that he mentioned in Sweden that when a machine is pacing you, the human being feels more stress than he feels if he's being paced by other people, other human beings?

Mr. O'BRIEN: Okay. I have actually been in Sweden, have seen some of these operations. You can rest assured that there is a lot of what we call today quality circles in a lot of Swedish government and in a lot of— excuse me, Swedish workplace. They do have what they call worker democracy. People in Sweden industry serve on the board of directors. Rest assured that the machines that are so-called pacing the individuals are agreed upon goals by both the worker and management. So the comparison is not really a fair one because it doesn't exist in that sense.

MacNEIL: But do you deny the point that human beings have more stress when they're being paced by a machine than they are when they are being paced by fellow humans?

Mr. O'BRIEN: Again, it depends on a specific circumstance. If a machine is speeded up using the— what we consider poor nomenclature, speedup, to an unreasonable level, yes, then of course the individual is under stress. But the vast majority of industry does not have a machine pace at a level that the worker cannot comfortably adhere to.

MacNEIL: But you disagree with that, Mr. Shaiken, do you?

Mr. SHAIKEN: Yes. Very clearly, the study in Sweden that I referred to was followed up by another study in the United States of American workers that came to very similar conclusions. It's not simply a question of speedup, although speedup is very often something that comes out of these kinds of systems; it's the pervasiveness, it's the fact that each minute of your workday is monitored, that each work activity is monitored and recorded, and very often any deviation from a preset norm results in discipline being taken. So it's not simply a question of gathering information in the workplace, which is often quite a desirable goal, which computers can do quite well; it goes a very important step beyond that, which is it uses the gathering of that information as a disciplinary tool and as a tool to pace workers. So regardless of what the pace is, the pervasiveness of the system, the way it covers each second of what you do, I think the real core of the problem is there, and that's what results in quite a lot of stress, as shown in any number of studies; and beyond stress, real health and safety problems as well, stemming from the stress, which stems from the monitoring.

MacNEIL: Let's go to the question of discipline, Mr. O'Brien. The workers we saw in that report had the discipline in the form of a pay incentive. If they worked harder and the machine measured it, they got more pay. If they worked less hard or achieved less, they got less. Do you approve of your system being tied to the amount of money you make and piecework?

Mr. O'BRIEN: Yeah, that could be either called incentive or gain-sharing, any of that — certainly it has its applicability in that area.

MacNEIL: Are you in favor of it?

Mr. O'BRIEN: Again, if the system is properly constructed and management is properly aware, the employees are well aware of what's going on — sure, I think that's a— gain-sharing, there's nothing wrong with that. I don't-- I am still bothered by the statements by Mr. Shaker *[sic]* there about all the disciplinary things that are being done with paced work, and that's just not true. Many, many companies use this to find where problems may exist, and as a result of these problems may in fact do retraining; or may in fact [find] an employee may not be suited for a given job, and the poor individual is working very hard but can't attain it — at least this will show something is wrong, let's investigate the reasons. Not necessarily firing the individual; it may be placing the individual in a job for which he or she is more compatible.

MacNEIL: So you agree with what Equitable told Charlayne that if they feel stress, the workers have induced it in themselves?

Mr. O'BRIEN: That's only partly true. Some of the stress is caused by unknown situations. If you're putting in a program of work measurement where you're talking about a specific routine in which to go through, if the worker is not fully understanding what is happening and what these work standards — this magical term, work standards — mean, how it affects them; if this is put in as an unknown quantity, there is going to be fear and there is going to be stress.

MacNEIL: Do you have a final comment, Mr. Shaiken?

Mr. SHAIKEN: Yes. I think what we're looking at here isn't an abuse of something; it's the way the system is structured that's the real problem. And it isn't just that a worker is feeling the stress, that it's self-induced. The stress is a very real result of structuring work in a certain way. And at stake isn't simply the 18 or 20 million clerical jobs in this country, as significant as that is; at stake is really a profound new way of ordering work. Now, the computer technology gives us a choice. We can have more autonomy or more authority in the workplace. And these systems when they're used to monitor and control and ultimately pace and discipline workers, are using computer technology to extend authority. I don't think this is necessary—

MacNEIL: We— I'm sorry to interrupt you. We have a machine pacing us, and it's called a clock. We have to obey it. Thank you both very much. Judy?

WOODRUFF: From the medical world, some good news today about the early detection and treatment of cancer. A group of researchers at the National Cancer Institute is using chemicals to delve into the innermost construction of the body's genes to distinguish healthy cells from cancerous ones. According to a work published in the latest issue of *The New England Journal of Medicine*, doctors say the technique is permitting them to diagnose early cases of blood cancer and may one day lead to early detection of other kinds of cancer as well. The researchers use a chemical enzyme to slice up genetic material and single out white blood cells that are cancerous, even when only a few of them exist. They described one case in which they diagnosed a kind of blood cancer which is treatable in a patient who doctors thought might have another kind of cancer which often cannot be treated. One of the researchers said the technique will help define which patients would respond better to therapy. Robin?

MacNEIL: William Demarest, the actor who specialized in playing tough-talking characters with hearts of gold, died today in Palm Springs, California. He was 91 years old. Demarest appeared in the first sound movie, with Al Jolson, *The Jazz Singer*. Among the others were *Diamond Jim*, *Mr. Smith Goes to Washington*, and *Miracle at Morgan's Creek*. On TV he played Uncle Charlie in the series called *My Three Sons*. Judy?

WOODRUFF: Turning now to a final look at today's news, the Pentagon's long-awaited inquiry on the Beirut truck bomb that killed 241 U.S. servicemen was released today. It criticized the decisions of the military commanders responsible for the Marines' security and the decisions that sent the Marines to Lebanon.

Jesse Jackson says he'll probably go to Syria after all. The Democratic presidential candidate wants to negotiate the release of the U.S. airman shot down over Lebanon.

In Moscow, the unusual is becoming commonplace. Soviet leader Yuri Andropov once again failed to show up at a major event. But the Soviets stressed that Andropov, although ill, is still in control.

In Buffalo, New York, a major gas explosion devastated seven downtown buildings, four firefighters reported killed. Good night, Robin.

MacNEIL: Good night, Judy. That's our NewsHour tonight. We'll be back tomorrow. I'm Robert MacNeil. Good night.

Transcript produced by Journal Graphics, Inc., New York, N.Y.

"WORK MONITORING"

ABC-TV Nightly News, May 29, 1984

PETER JENNINGS

You can hardly turn on the television these days or open the pages of a magazine without seeing something on the computer revolution. The question in 1984 is where are they not being used. We've almost all been seduced by their capabilities, but do they also pose a threat. Some employers are now using computers to keep track of their workers' productivity. ABC's Jack Smith has been on special assignment.

WOMAN

It's pressure and it's stress. I don't care for it. It's dehumanizing.

WOMAN

You're not allowed to be human, in a sense. You're almost like a mechanical being.

JACK SMITH

It is the dark side of the information revolution. All over America, the computer is replacing the typewriter. But what's gotten little publicity is that some employers are increasingly using their new office systems to spy on their employees. The computers not only type words on a screen, they can also record everything the employee is doing and send it to the boss.

PROF HARLEY SHAIKEN

All of a sudden the manager has the opportunity not only to look at the final output at the end of the day, but to also see how the secretary uses every minute of the day.

JACK SMITH

This is AT&T's long distance exchange in Wayne, New Jersey. Computers here print out a record of every move an operator makes.

CHARLES THORNTON

Each time an operator logs on to position, the statistics of that particular operator in terms of the calls handled and the amount of time it took that operator to handle those calls is computed.

JACK SMITH

AT&T doesn't tie pay to output, like other companies, but operators who are slow can be disciplined. They even have to switch on a clock that times them on the toilet.

WOMAN

There are periods of the day when it is necessary to leave the room. We have to account for those minutes that the operator is away from the board.

MARY FEINHALS

It's demeaning. That's just the best word for it.

JACK SMITH

Evylin McClain works for the New York Times, which recently began monitoring its classified ad takers.

EVYLIN MC CLAIN

I have not had to raise my hand when I had to go to the bathroom since I was a little kid back in grammar school. But now I have to raise my hand and hit that button and tell that machine that I am leaving my desk.

JACK SMITH

The Newspaper Guild has filed a grievance against the Times, for unions don't like monitoring, and it's increasingly surfacing now in labor disputes, most recently one between Equitable Life Insurance and its claims processors.

KAREN NUSSBAUM

The conditions of work that are created became dreadful. It meant that instead of having a supervisor you had a policeman sitting in your lap.

CHARLES THRONTON

This particular form of monitoring the productivity with a computer, this goes on continuously, for the most part they forget it's even going on.

JACK SMITH

However, studies are now beginning to link monitoring to anxiety, exhaustion and heart disease. And they also show that the quality of work suffers.

BECKY ALFORD

It's hard to function 100 percent when you know that someone's watching every move you make.

JACK SMITH

But monitoring does make employees work faster. That's why critics say even the best managers can be seduced by it. It allows them not only to improve office efficiency, but also, for the first time, to control the white collar worker. That is why some supermarkets now monitor their checkers, airlines their agents, and why credit card companies and banks do it too. In fact, potentially any place computers are installed.

PROF HARLEY SHAIKEN

I think there's no question that productivity goes up when you monitor people, but is that the best we can do as a society, to electronically chain people to work stations to increase their productivity.

JACK SMITH

Critics say that monitoring is turning the office of the future into an electronic version of yesterday's sweatshop. It's already been banned in one state, and it promises to become one of the major labor issues of the next decade. Jack Smith, ABC News, New York.

Office Automation Outlook: 1985-2000

Alan L. Porter, J. David Roessner
Frederick A. Rossini, Keith R. Nelms

Georgia Institute of Technology

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Final Report

Office Automation Outlook: 1985-2000

Alan L. Porter
J.David Roessner
Frederick A. Rossini
Keith R. Nelms

Georgia Institute of Technology
Atlanta, Georgia 30332

February, 1985

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A. Introduction

Office automation conjures images from the mundane electric typewriter to the computer-dominated, artificially intelligent "office of the future." We wonder what is to become of the office and the office worker as we know them? What new jobs will emerge? What gains in productivity? This study aims to identify major issues in office automation for the next fifteen years through three means:

1) identifying important areas of technological development to watch;

2) anticipating likely patterns of adoption of office technologies; and

3) pointing out changes in office work likely to result from adoption of these technologies.

In a forecasting sense, these aims must be moderated by recognizing the great uncertainties involved. Our society is riding the steep slope of the onset of the 'Information Age.' Information work already occupies over half the American workforce (Nilsson, 1984; Roessner *et al.*, 1984). In this milieu, we seek to identify the important directions of change and likely milestones.

Information work encompasses various people, performing various tasks, with various technologies. Only some of this work takes place in an office. To reach a working definition of office automation, we consider who is doing what, with which technologies.

Information technology includes computers, communications, and information manipulation devices. This technology is changing rapidly. As a consequence, both how we perform information work and what work we do are changing radically.

The changes taking place in information work make it difficult to specify what we mean by office work. Tasks once performed in the traditional office place may be done elsewhere nowadays, as electronics extend the office 'home' or 'offshore.' What is being done back in that office place may include tasks once considered not to be office work -- e.g., inventory control. In essence, office work is evolving into new forms. We must, therefore, be careful not to define office work too narrowly.

For present purposes, we define office work in terms of six purposeful, information handling actions:

1) Information Intake

2) Information Production and Transformation
3) Database Management
4) Information Processing
5) Information Dissemination
6) Interactive Communication.

We believe this approach is most suitable to the fluid situation that exists. We elaborate on these actions in Section B.

Our study includes three of the four major information worker groupings (clerical workers, managers, and technical/professionals), leaving aside salespersons. However, we recognize that professionals and technicians (and others) perform a considerable amount of information work not usually associated with the office (e.g., in manufacturing, medical care, teaching). We restrict our focus to a traditional sense of office work because other information work is apt to use somewhat different technologies.

Our study team prefers an open perspective on "office automation." We include a technology if it facilitates one or more of the six information actions within the general office domain. For instance, it makes no sense to exclude mainframe computers when they further the actions. Office applications software can often run on personal computers (PC's) or mainframes. However, uses of mainframes and PC's have been distinct up to now; therefore, our data on office automation emphasize the microprocessor-related technologies. Yet, we recognize the trend toward interlinked systems is likely to involve various sizes of computers and a variety of other devices in the future. Thus, we adopt the view that office automation includes any information technologies bearing on office work.

B. This Study

This has been a short duration study (September, 1984, through January, 1985). As such it has drawn heavily on others' primary research. Such material has been synthesized to produce our two basic documents (appended):

1) Outlook for Office Automation Technologies: 1985-2000 by Fred Rossini, and

2) Market Penetration of Office Automation Equipment: Trends and Forecasts by Dave Roessner.

Results are highlighted in Sections C and D.

We also convened a panel consisting of the six Georgia Tech

Office Automation Group researchers and twelve outsiders representing information technology vendors, users, and consultants (list appended). These 'EFTE' panelists reviewed two rounds of materials by mail; participated in a one day workshop involving two rounds of informed, structured interaction (Estimate, Feedback, Talk, and Estimate); and then completed a final round of estimations by mail. These estimates of the extent to which office automation will (1) save office labor, and (2) increase the information workload through expanded opportunities are presented later. The appended EFTE Process describes the steps followed and the materials used.

We devised the information handling actions mentioned earlier during the course of this study. We had recently completed a project for the Department of Labor (Roessner *et al.*, 1984) on the impact of office automation on clerical workers in banking and insurance to the Year 2000. That study convinced us that consideration of information handling offered the best mechanism to project how changes in information technologies would affect office work. The typology we used in that study consisted of six information functions: input, processing, output, data base management, communications, and systems monitoring.

The recently completed study had focused on clerical workers. We now turned to the literature to find out how managers and office professional/technical workers spend their time. Managers are usually characterized in terms of their level of responsibility (e.g., chief executive, senior manager, ... first level manager). The Office of Personel Management defines professional occupations as "those that require knowledge in a field of science or learning characteristically acquired through education or training equivalent to a bachelor's or higher degree with major study pertinent to the specialized field." In the office environment, professionals include engineers, accountants, and computer specialists. Technical occupations typically support a professional or administrative field. Clerical occupations entail structured work in support of office type operations.

We found various ways to depict the work done by these occupations. The information functions that served to characterize clerical work for us were not as satisfactory in describing the work of professionals and managers. Table 1 of the appended paper on Information Work Actions and the EFTE Strategy illustrates the diversity in specifying how managers, professionals, and other office workers spend their time. On the one hand, most of the empirical evidence emphasizes discrete activities (e.g., reading, typing, telephoning) lacking explicit purpose. On the other, conceptualizations that address purpose in terms of, say, leadership and decision making do not seem to be able to document people "doing" much other than information handling.

We settled upon the six information handling actions as a viable formulation. These are purposeful, yet can be associated with discrete activities (see Table 1), albeit with some activities serving multiple actions. Most importantly, they reflect our sense that information handling work spans occupational groupings. Commonalities in managers, professionals, or clericals performing 'database management' exceed their differences. As such, the actions provide a vehicle to consider technological changes. We can relate specific office technology developments to one or more of the actions, and, in so doing, link these changes to changes in office work. (The appended EFTE Process details how this is done.)

We need to mention two other important decisions in structuring the EFTE. Both reflect tradeoffs between the level of detail that this structured panel forecasting process could handle and that salient to differences in office automation practices. For one, we chose to consider three prototypical jobs: middle managers, office professionals, and general office secretaries. For the second, our final EFTE formulation does not explicitly consider differences among industry sectors in adopting office automation. Section D does provide our panelists' sense of which sectors are likely to be leaders and laggers. Details on these decisions are available in the appended EFTE Process documents. Sections E and F present the EFTE panel perceptions on how office work is likely to be affected by office automation through the Year 2000.

C. Office Technology

We find it helpful to consider information technologies at three levels of aggregation. Components are discrete parts, such as microprocessor and RAM chips, that are not functionally free-standing. Devices are functional units built of components. Examples include word processors and microcomputers. Systems are composed of devices interconnected by some electronic medium -- e.g., an electronic mail network among workstations.

The amount and quality of available trend data from which to compile convincing forecasts are inversely proportional to application relevance. Our appended Office Automation Technologies (OAT) paper samples the growth trends for certain properties of components, for instance. The punchline of the component trends is that hardware developments show continuing exponential (or nearly so) improvements in overall performance and in performance/cost ratios (OAT, Figures 1-3).

However, it is the devices and, even more so, the systems that will alter office work. The appended technology description and forecast paper tracks unit sales of selected devices and the introduction of systems with new capabilities (OAT, Figures 4 and 5).

In general, we find that office technology will not be constrained by hardware performance and cost factors. We compiled a broad list of office technologies identified from the literature to get our panelists' perceptions on which are likely to prove most influential (see Table 1, Revised). Table 3 tallies those perceptions of which devices and systems are important to office automation. It would be nice to be able to point to one or two technologies as critical to each information handling action. That just is not the case. Information actions appear subject to the influences of a wide range of information technologies. At the workshop, panelists also advanced the notion that advancing technologies blur distinctions among the actions (and changes in the actions blur distinctions among office occupations).

A second feature that stands out from consideration of the candidate technological developments is that much of the technology is available now. Of the technologies considered in our review (as reflected in Tables 1 and 3), most are available now, or only require incremental improvements to exert a force on office work practices in the 1980's and 1990's.

Only four of the technologies addressed seem to require major advances. These areas to watch for significant technological developments are image processing, voice recognition, distributed processing, and AI/expert systems.

Image processing (OAT, p. 3-4), perhaps even more than optical character recognition (CCR), could impact dramatically on certain bulk information input operations. The possibility of capturing and digitizing the whole image offers possible advantages, as in bank processing of checks. OCR has advanced to the stage of 99% accurate reading of single handwritten numbers (OAT, p. 3). Projections suggest commonplace input of both typed and handwritten visual material by 2000. We might caution, as one of our panelists advised, that adoption will be discontinuous. For instance, OCR use for checks entails significant capital commitment, changes in entrenched organizational practices, and inducing behavioral change in customers -- in a word, standardization of technology.

Voice recognition has achieved initial commercial acceptance where a limited vocabulary is used (e.g., inspections). Limited continuous speech recognition systems are projected to be in use in the 1990's (OAT, p. 5). Some time thereafter, voice input appears likely to alter information handling radically, in our opinion.

Distributed processing in networks of office microcomputers (as illustrated by present Apollo Computer, Inc. networks) can, in principle, take advantage of otherwise unused processing and storage capacity, and complement distributed databases (OAT, p. 6-7). However, it does not appear likely to impact office work processes seriously before the Year 2000.

Artificial intelligence, including expert systems, represents the most far-reaching long-term office change agent. The key components of computer systems that perform intelligent tasks are knowledge bases and reasoning engines (OAT, p. 10). Knowledge acquisition is presently a major constraint in that a human enters each piece of information individually. AI development will receive substantial emphasis throughout the world over the next decade; it is an important aspect of the Japanese fifth generation computer program. Substantial improvements in structuring and implementation of individual knowlege-based systems should appear by the mid-1990's. AI systems will become more integrated by the late 1990's and begin to play central roles in system operations as well as specific application programs (OAT, p. 10).

A key to these target technological areas and to improvements in others is software, not hardware, development (OAT, p. 8-9). Software is the bottleneck area for office automation advances. One of our panelists pointed out that the software problem is likely to get worse before it gets better. As the target user population expands, the level of computer sophistication drops. Training becomes a primary concern. It is much tougher to program for interactive systems than for stand-alone devices (e.g., graceful recovery and safe data sharing are concerns). Demand for moe integrated, much more user-friendly software will grow.

Software engineering looms as an area of considerable importance for office automation (OAT, p. 9). It is receiving increasing attention: witness an active commercial 'CASE' (Computer-Aided Software Engineering) workstations competition and the recent Department of Defense establishment of a Software Engineering Institute at Carnegie Mellon University. Programs will come to be written in higher level, more structured languages; using larger 'building block,' reusable modules; and offering rapid prototyping to test performance early in the development process.

Systems development is the final point to emphasize (OAT, p. 15-17). Systems involve physical linkage, shared formats, compatible information types (i.e., data, text, graphics, audio), and integrated applications systems. Present office system functions include word processing and document preparation, electronic and voice mail, administrative and decision support, electronic filing and records processing, and data processing. Two approaches to develop systems can be contrasted. One incrementally connects existing devices. The second establishes the basic office function needs first, then designs the system accordingly. The first poses a danger of technology driving the office functions; the second, of disruptive changes in office practices. Full integration is a future possibility that offers substantially greater potential for productivity gains and office reorganization.

D. Adoption of Office Technologies

The following highlights are drawn from the appended paper on Market Penetration of Office Automation Equipment: Trends and Forecasts (MP).

Attributes of the Technology That Affect Adoption. By and large, adoption of office automation does not hinge on future hardware developments. Neither does price appear as a major consideration. Further development of integrated general office function and specialized professional software is important. In particular, concerns about training and implementation costs can slow adoption. The most promising solution may well lie in devising software so friendly that it resolves the training problem. (Witness the current advertising thrust on how natural the Apple Macintosh is to use, in contrast to the IBM PC.)

General Influences to Consider. Over the short term, behavioral inertia and organizational resistance to change are slowing adoption. However, the positive response of office automation users to the technology suggests that this will be overcome well within the fifteen year study horizon.

General economic forecasts suggest that one might well anticipate at least two recessions by 1995, with renewed inflation a distinct possibility. We are not sure what impact these would have on the rate of adoption. However, time series suggest that availability and cost of capital in a firm in a given year do not relate closely to annual capital investment in office equipment and computers (MP, p. 11 and Figures 5-7).

Government could exert considerable influence on adoption. Restrictions to preserve jobs (or requirements that industry provide retraining) could slow adoption. Changes in investment incentives are certainly possible -- e.g., decreases in investment credits in line with closing tax loopholes or increases to enhance U.S. competitiveness internationally. We have not estimated the effects of such policy changes.

Sales Trends. Definitional problems limit the precision of available sales forecasts. Nevertheless, some very informative projections are possible.

Sales of office technology (MP, p. 14-16; Figures 9 and 10) in 1980 were a very substantial $10 billion or so (depending on what is included). This amounts to some 12% of non-farm equipment sales. Sales are increasing at about 16% annually. Projections are highly uncertain, ranging from a conservative $40 billion for 1995 to a liberal $58 billion in 1987.

More informative than dollar sales are installed base figures (MP, p. 14, Figure 8). These rise to astounding penetration levels according to International Data Corporation projections (1983). By 1990 there will be a microprocessor-based keyboard device in service for every white collar worker. Most knowledge workers (managers and professionals) will have the more powerful types of microprocessor-based devices, such as personal computers or workstations. By 1995, there will be further upgrades. Virtually all knowledge workers will be using electronic workstations on networks (e.g., with voice/data communication capabilities). The electronic office will be in place.

The Second and Third Waves. Look for fundamental restructuring of office work. The Second Wave involves creation of communicating office technology systems. Decisions to adopt at this systems level will have more of a 'go/no go' nature in contrast to present incremental choices to implement one more device, in one more area. These information system decisions will meet more resistance.

The Third Wave involves the managers and professionals as major direct users of office technologies. This will shift work functions from support staff. It will also alter the nature of the work as direct electronic communications become the way business is done. Office reorganization will spread over decades. Large differences will emerge among organizations in how leaders and laggers perform office work.

Differences in Rates and Patterns of Adoption. Different sectors will adopt office automation at substantially different rates. Competitive service industries in which office automation reflects in the quality of service provided customers will move rapidly (MP, p. 3-4). Once a given firm has initiated an improved service, the industry will follow promptly.

The finance industry provides a good leading indicator of change. It has reached the level of roughly $19,000 of capital equipment per "production" employee (MP, p. 9; Table 2 and Figure 3). (Of this, perhaps, $8,000 - $10,000 represents office automation, including automated teller, credit card confirmation, check handling, and bulk automation too.) This compares with manufacturing's $20,000 - $30,000 of capital investment per production employee. The finance industry has been the leader in the growth rate of capital investment per employee at 12.6% annually from 1960-1980 (MP, p. 11). And, the share of that capital investment in office and computing machines has been increasing as well -- from 29% in 1975 to 41% in 1980 (MP, Table 1).

It must be emphasized that labor productivity gains per se do not dominate decisions to automate. This is particularly the case for managers and professionals. Qualitative improvements in work constitute a more significant objective; however, these are even more difficult to measure. Benefits of office automation can include:

1) Time savings (person-hours)
2) Operational savings (postage, paper, floor space)
3) Response time (hours saved, not person-hours)
4) Quality of work (also job satisfaction)
5) Expanded or brand new services.

Labor is, of course, an important consideration in office automation (MP, p. 2-3). High office wages, especially of knowlege workers, offer an incentive to automate, as do localized shortages of certain workers. Labor resistance is likely to be greater where unions are stronger. In general, office workers (clerical, professional, and managerial) are not highly unionized. Labor resistance could escalate dramatically if unemployment rises. Conversely, shortage of labor in the form of programmers to remedy the software needs, trainers, and skilled operators could slow adoption.

Several other dimensions will affect adoption. Industries dominated by small firms will be more sensitive to costs. They suffer from less economy of scale for installation of office systems, software acquisition, and training. They tend to be slower to obtain information. Hence, they will tend to lag. Likewise, industries lacking significant competition will tend to lag in this innovation process. Small offices are also likely to lag for similar reasons, namely, cost concerns, lack of information, and diversity of work to be done.

As part of the EFTE forecast, participants estimated the rate of adoption by sectors. Taking into account panelists' reflections on sector ordering in the final mail round yields the following (from leading to lagging in adoption of office technologies):

1) Banking, Finance, Insurance, Real Estate
2) Communications
3) Transportaton, Utilities
*) Public Administration
*) Service
*) Wholesale and Retail Trade
*) Manufacturing
8) Agriculture, Mining, Construction.

A higher degree of uncertainty prevailed about the '*' sectors. Public administration is heavily white collar, well-trained, and under pressures to increase productivity, despite the lack of competition. Services are very diverse, and tend to be conservative and shy of capital, but some compete on quality of services that can be affected sharply by office technologies. Wholesale/retail trade is highly fragmented, but customer service could be directly affected. Manufacturing already has much automation in order entry, management information systems, and interests in electronic databases, but office automation does not bear as directly on customers.

E. Impacts on Office Work

Some Basic Considerations. The revised Table 1 provides the starting point for this discussion of our EFTE panel's perceptions of how office work will be altered by office automation.

Office work is considered in terms of six information handling actions. Related discussions of these actions appear in Sections A and B and the "Information Work Actions and the EFTE Strategy" appendix. However, the operational definitions are contained in Table 1 (revised). (The revised form was used in the final mail round of the EFTE on which these results are primarily based; the earlier workshop form is shown in Appendix 3.)

Comments by the participants suggest that emerging technologies are blurring the distinctions among information handling actions. For instance:

- Information Intake and Production may be fused by automated library search with full text retrieval.
- Database Management and Processing may be combined in programs that retrieve, analyze, and refine data.
- Information Dissemination and Interactive Communication may both be present in E-mail and V-mail (electronic and voice mail networking).

The coming together of previously discrete office work functions appears to reflect a real transition, not an artifact of this categorization.

Table 1 (revised) lists work activities empirically associated with middle managers, office professionals, and general office secretaries -- our three target job types. Table 2 consolidates these for each action as of 1980, our base year. (Some activities can serve multiple actions. Also, the tally for secretaries sums to 95% and contains a typographical error on info search. Therefore, we reconsidered the literature sources in arriving at the rough estimates of Table 2.)

Managers and professionals show quite similar time allocations. The primary difference is that managers spend more time in interactive communications (meetings and phone conversations), while professionals spend more time processing information (desk work). General office secretaries exhibit a distinctly different time pattern. This difference is heightened if one recognizes that these 'information' workers engage in support activities within actions -- Information Production by managers and professionals is primarily writing; whereas by secretaries, Information Production is primarily entering what others have written through a keyboard device (Table 1). However, it is advantageous to include both sorts of activities in one action in the sense that office automation may lead to the 'knowledge' workers 'writing' directly at a keyboard (as I am doing in composing this).

Note in Table 2 that we do not project major shifts in 2000 in the extent to which these jobs emphasize these six actions. For instance, managers may be doing more information processing, but technological support compensates by allowing them to do more work in the same time.

The last column of Table 1 provided a vehicle for EFTE participants to indicate which technologies would significantly affect each of the actions. Table 3 tallies their responses, as discussed earlier in Section C.

The EFTE process addressed (1) how technology is likely to change, and (2) how those changes are likely to affect office work. Studies of innovation suggest that societal demand 'pull' complements technological 'push.' At the present stage in the evolution of the Information Era, the push of new technological potentials is, perhaps, the dominant factor. Programs such as Lotus 1-2-3 seem to create need, as workers see what the programs can do. As familiarity with information technology grows, potential users will reach a clearer sense of what they want (immediately and long term). One of our panelists notes that office automation users buy differently than those who just purchase equipment for others to use. Another anticipates that a younger generation of workers will work differently. They will think computer, think graphics, think integrated databases. Office technology will surely affect the conduct of office work, but the demands of office workers will also affect the technological development.

Savings. The EFTE panelists provided two sets of quantitative estimates. The first pertain to Savings, defined as:

> the % of time it will take the typical worker
> to perform a unit of an information action
> in 1990 (or 2000) compared to the time it
> actually took in 1980.

Savings reflects the average effect of actual office practices in 1990/2000, relative to those of 1980.

New technology can save time in the performance of the activities once done using an older technology. It may also lead to different work activities. The purposeful information handling actions are suited to consideration of both sorts of changes. Time may also be saved as, for instance, managers do their own keyboarding. In "Some Quick Reference Information for the EFTE" (appended), we note a number of ways office technology can save information handling, for instance:

* Computer-aided processing can reduce analysis time.
* Direct data entry via Optical Character Recognition or voice recognition obviates the need for keyboard entry.
* Electronic filing and output eliminates paper handling operations.
* Text processing is speeded up by automatic indexing, global editing, automatic formating, automatic filing of revisions, etc.
* Message systems reduce time spent on memo writing and phone calls.

Time savings amount to labor productivity gains. Such gains have not been easy to document, particularly for non-routine office work automation. There are certainly presumptive indications -- the two financial industries that have led in the introduction of computers show the highest productivity gains (Drennan, 1983). Because such Savings are a vital feature of office automation, yet are difficult to detect in time series, we turn to the EFTE panel to estimate how much office work time will be saved by use of new technologies.

Table 4 presents the estimated time savings due to office automation. The median, 'best' estimates are of most interest. Those represent the most likely effect on labor productivity (amount produced per unit of labor input). Recognize that these estimates incorporate implicit judgments of what technology will be available; who will use it; for what; and to what net effect -- averaged across three types of office workers, in all sectors of the economy. We rely on expert opinion because we believe that all these judgments are critical and we don't have explicit models of each.

It is, therefore, important to consider the spread of the estimates as well. Table 4 offers two such indicators. The 25th and 75th percentiles (also known as the interquartile range) for the best estimates show how closely the middle half of the panelists' estimates agree. These are shown as error bars in Figure 1. This interquartile range averages a very reasonable 17% for 1990 and 19% for 2000 across the six actions.

Respondents were also asked to give the "lowest values considered reasonable or likely" and the "highest values considered reasonable or likely" for each action, for each of 1990 and 2000. Median responses on these estimates are, not surprisingly, more extreme than the 25th and 75th percentile 'best' estimates. The reader may decide what bounds on the estimates are most suitable. In our discussions, we emphasize the interquartile range of the 'best' estimates.

The Savings profile is, above all, broad and deep. Changes are not restricted to certain information actions. The median 'best' estimates show a unit of work being done in 1990 in 76% of the time it took in 1980 (averaged across the six actions). For 2000, this drops to 57%. Put differently, in 2000 we could accomplish 1980's work with 43% fewer workers (assuming equal amounts of each action are performed -- Table 6 estimates labor demand taking into account the different 1980 time allocations per action).

Change appears highly certain. For instance, the 75th percentile 'best' estimates for 2000 average some 69% (the median High values average 76%). Or, conservative estimates of work time saved by office automation still indicate that we would cut the workforce by a quarter while doing the same amount of work.

Change could be even more drastic. For instance, the 25th percentile 'best' estimates for 2000 average 49% (the median Low values average an even lower 42%) -- savings of at least half of the workforce to perform the amount of work done in 1980.

It is just such projected productivity increases that cause grave concerns about possible rampant unemployment.

Workload. The second set of quantitative estimates pertain to Workload, defined as:

> the amount of the given type of office work that will be performed in the year 1990 (or 2000) relative to the amount performed in 1980, per unit organizational output (final products or services).

Workload reflects the change in the 'in-basket' amount of work to be done. It takes into account new potentials and new expectations attendant to the implementation of newer office technologies. For instance, if one foresees the total pool of managers doing twice the amount of Information Intake per unit of organizational output, compared to 1980 practices, then workload would be 200%.

In this section, we are addressing Workload per unit of organizational output. How much more or less of each information handling action will be undertaken per 'widgit' (product or service delivered)? Were one interested in aggregate labor demand, it would be necessary to take these calculations one step further. That is, one would project trends in organizational output (units of goods or services produced, not dollar values) for 1990 and 2000. These would then be multiplied by the work amounts per unit of organizational output (see Table 6). Derivation of appropriate output measures, especially for services, requires care (Roessner, *et al.*, 1984).

Our model of office automation takes Savings as one primary effect. However, as discussed earlier, a whole array of possible benefits is potentially available. Organizations will take different paths. Some will maximize labor savings (e.g., cost-competitive firms that are labor-intensive). Others will enhance the information content of their products or services to improve quality. New products and services will find their niches.

These changes can affect managers, professionals, and secretaries differentially. The nature of work tasks will change as the computer and electronic communications become essential elements. Human roles will evolve to complement office technologies. Our panel anticipates that the duties of different occupations will become less distinct. These changes may sum up to mean more work to be done by some; less, by others.

'Knowledge' workers may perform tasks aided by technology without help from support staff. Fewer support staff implies fewer managers to supervise them. That means a streamlined organization, simplifying communication and coordination. That suggests reduced meeting time, less information dissemination activity, and simplified scheduling. In turn, staff can be further reduced by this vertical and horizontal integration. Workload is reduced.

Conversely, office automation may act to increase Workload in various ways. New capabilities will generate new needs. For instance, ready access to data analysis and simulation programs will prompt more analyses per given market study or planning effort. We already see evidence of enhanced financial services offered to customers. More data will be processed, more information electronically filed and transmitted. That points to greater Information Intake as well.

We called on the EFTE panelists to judge whether Workload (per unit organizational output) would increase or decrease, and by about how much. Table 5 summarizes their 'best' estimates. Their judgement is clear -- Workload will increase markedly. Note the median projections. Workload increases for every action for managers and professionals. It increases less markedly, but still substantially, for secretaries. Note the 25th percentile judgements also. General consensus of substantial increase holds for managers and professionals. The 75th percentile values suggest that workload per unit organizational output could double for many actions by 2000. Increases in processing are seen as most pronounced. Increases in Interactive Communication work are least pronounced.

The majority see secretarial Workload increasing. However, a significant minority estimate a decrease in certain secretarial actions -- declining most in Interactive Communication, somewhat in Dissemination, and possibly in Information Production and Processing as well. Certain panelists weight the automation pressures acting to reduce Workload higher than do others.

Labor Requirements. Table 6 combines the Savings, Workload, and allocation of work time among the actions to estimate demand for middle managers, office professionals, and general office secretaries.

The calculations are interesting. Basically, we are multiplying a value smaller than 1 (Savings in time to perform a given action) by a value greater than 1 (Workload projected to increase in virtually all cases).

The s*w products show some increases and some decreases. Table 2 shows percentage of time for each information handling action based on these products, normalized to total 100%. We forecast that managers and professionals will spend relatively more of their time on Information Intake and Database Management, less on Information Production and Dissemination. Secretaries also will spend relatively more time on Database Management, with Information Intake second in increase. They will spend somewhat less on Interactive Communication, Information Dissemination, and Processing.

Overall, we tally up a slight decrease in demand for managers and professionals and a moderate decrease for secretaries by 2000 (per unit of organizational output)(Table 6). That is, we will enjoy better products and services enriched by more information content. On balance, however, this increased Workload will be outweighed by labor productivity gains, so we will need somewhat fewer workers to produce a unit of output.

These projected labor requirements are based on the multiplication of two estimates. It is important to assess how sensitive these are. Figure 2 provides alternative projections. The low projections are derived from 25th percentile value 'best' estimates of Savings multiplied by 25th percentile value 'best' estimates of Workload. The high projections reflect 75th percentile values of each. Our panelists are quite consistent in predicting that office technology will result in labor savings (Figure 1) and also that workload per unit of organizational output will increase. However, labor demand, reflecting the product of these, is highly uncertain. The median estimates suggest a modest decrease, but the interquartile ranges reach from substantial decreases to moderate increases.

Conclusions. These projections contain areas of good agreement and areas of high uncertainty. There is strong consensus that:

- * The bulk of the office technologies are available; they do not depend on future performance or cost breakthroughs.
- * These technologies will be adopted, more rapidly in certain sectors to be sure; the office will be remarkably automated by the Year 2000.
- * Office automation will result in dramatic labor savings to accomplish given information actions.
- * The amount of information work to be done per unit of organizational output will increase greatly.
- * The nature of office work -- who does what -- will change dramatically.

Considerable uncertainty surrounds:

- * The timing of development and adoption of certain high impact technologies -- voice recognition and artificial intelligence/ expert systems;
- * Labor force requirements, as a function of Savings, Workload, output demand, and economic and political forces.
- * The nature of the changes in office work -- who will be doing what in the office of the future.

Precision is made difficult by the interactive, systemic nature of the office changes. As discussed, the implementation of these technologies is iterative. Some new technology arrives on the market; that leads to recognition of some need. Second generation technology is targeted to that need. Another user sees a potential and further developments branch off. Those prospective branches are impossible to predict with accuracy.. For example, jobs will change. The EFTE workshop touched on the gaps between our prototype jobs. For instance, between the general office secretary and the managers and professionals, one can locate executive secretaries, administrative assistants, and technicians. Differences will decrease. But who will carry out the evolved tasks? Upgraded secretaries, an expanded group of administrative assistants, or managers utilizing office technologies? Occupational employment projections appear particularly precarious. To the contrary, we can say with certainty that most all the information work actions will be affected by office automation by the Year 2000.

F. Office Work in the Year 2000

As the last item in the EFTE final round, we asked participants to describe how they saw the three prototype jobs evolving to the year 2000. A composite of their ideas follows, drawing heavily on Tora Bikson's description.

In general, we project that the three positions will be much less distinct than they are today. Everyone will come to resemble the professional. All will rely heavily on information technologies. Electronic data bases and communication media will provide common ground for increased information processing and for easier interaction among workers.

Furthermore, the workload expected of all three positions will increase. Yet, use of information technologies will more than compensate by increasing productivity. As a consequence, labor requirements for all three job types, per unit of organizational output, will drop -- slightly for the managers and professionals; moderately for general office secretaries.

The Middle Manager. Leaner organizations have fewer vertical management levels in the Year 2000. Managers handle more information directly, rather than through subordinates. Management responsibility emphasizes systems of people and technologies.

Managerial activities have come to more closely resemble professional activities. They more relate to discrete projects (e.g., integrating new information technology into functioning systems), with measurable outputs. Highly usable computer programs enable the manager to directly get at much of the increased amount of information needed. The electronic workstation links her/him to corporate and external data bases, and to corporate colleagues. The manager is on-line.

The manager does much more for her- or himself than in 1980, aided largely by information tools in lieu of support staff(e.g., data entry facilitated by voice recognition, and information dissemination and scheduling meetings through electronic mail) without much use for secretarial assistance. (S)he has become more technical. The manager performs analyses using advanced software systems -- taking the place of a professional on many data analyses, projections, and so on.

Managers distribute their activities much as they did in 1980. They do, however, spend a lot of time at their workstations, drawing on powerful software and, even, expert systems. Managerial distinction continues to lie in the way they organize people, but also in relating people to technological systems. The good ones stand out by exerting leadership and control, showing judgment about how best to achieve organizational missions. In short, human management and communication skills remain paramount, but proficiency in supporting those by use of information tools is now also critical.

The Professional. Professional work has changed the least, even though office professionals make the greatest use of the most advanced information tools. Office professionals, like managers and secretaries, do most of their work with computer assistance. They make use of expanded data resources, drawing on both numeric and full text information databases. They draw on truly advanced processing capabilities, stretching into expert systems and artificial intelligence.

Nonetheless, the nature of their work remains much as it was in 1980 -- professionals simply draw on better information and advanced processing tools. Given these capabilities, the mark of the good professional lies in his/her judgment -- intuitively selecting better development courses to pursue, integrating data analyses, and interpreting results. Improved communication vehicles facilitate team efforts, both on-site and dispersed. Requirements for professional judgment combine with enhanced communications to link the professional more closely to upper management as well.

The General Office Secretary. Need for the traditional general office secretary has largely disappeared. Managers and professionals perform information actions with the help of smart systems. The component activities are not completely automated, but flexible, manipulable systems make it easier to handle these directly than to farm out to a secretary.

The evolved information support needs call for two different information workers. Data entry work, for instance, not done directly by the knowledge worker (manager/professional) or customer necessitates low-end support on the order of the clerk-typist. However, such positions are intrinsically low in quality of work life and offer no career path in Office 2000. Low-end work is coming increasingly to be automated.

On the other hand, the "information assistant" has emerged. Such high-end positions combine para-professional, para-manager, and 'Girl Friday' duties. This competent information technology user performs information search, data base management, and regular information processing (e.g., preparing a report on sales activity in each of the branch offices). Compiling information, formatting, and editing reports at the workstation balance with personal support activities (e.g., making travel plans for superiors). The high-end secretarial evolution presents a challenging and variegated position, suited for advancement into managerial status.

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Table 1 (cont'd)

Actions	Definitions	Activities	%M	%P	%S	Technologies PLEASE LIST TECHNOLOGIES LIKELY TO EXERT A MAJOR INFLUENCE ON EACH ACTION: BY 1990: BY 2000 (not by 1990):
Information Intake	The acquisition and ingestion of existing information from outside the organization into the human's head; Includes also: search outside the job-holder's work information system, screening, reading, listening	Reading Incoming Mail (Info Search) (Meet/Travel)	10 5 5 40	10 5 5 20	2 10 5 5	
Information ~~Creation~~ PRODUCTION (AND TRANSFORMATION)	Generation of ~~"[illegible]~~ information" in the form of memos, reports, speeches correspondence, etc. Includes also the entry of information into a technological system by the job-holder.	Writing Dictating (Typing)	15 2 1	15 1 2	3 3 35	
Database Management	The storage, retrieval, and update of information within the organization.	Filing Paper Handling (Info Search) (Typing)	2 1 5 1	5 2 5 2	5 3 2 35	
Processing	Reviewing, revising, analyzing, modeling, planning, scheduling, etc. Includes also deciding, selecting (e.g., which models to use). Includes both routine (rule-driven) and non-routine info processing, with the former more amenable to automation.	Proofing Calculating Scheduling	1 5 2	5 15 2	3 3 3	
Information Dissemination	"One-way" or "broadcast" communication (speeches, instructions, reports, *etc.*). Includes also letters	Copying (Telephone) (Meet/Travel)	1 10 40	3 10 20	5 10 5	
Interactive Communication	"Two-way" exchange of information ~~[illegible]~~ (meetings, conversations). Distinct from Dissemination in terms of the intent of quick feedback.	(Telephone) (Meet/Travel)	10 40	10 20	10 5	

CANDIDATE "OFFICE" TECHNOLOGIES (Please use the letter codes in making entries above. Do not report items already listed for 1990 in the 2000 column. Some have found it easier to take each technology and decide which ACTIONS it could affect, rather than vice versa.)

A. Image Processing
B. Optical Character Recognition
C. Touch Input (e.g., mouse, touch-sensitive screen)
D. Voice Recognition
E. Word Processors
F. Microcomputers
G. Distributed Processing
H. Distributed Data Bases
I. Removable Hard Magnetic Disks
J. Optical Disks
K. Laser Printers
L. Voice Synthesis
M. Facsimile Transmission
N. Baseband Local Area Networks
O. Broadband Local Area Networks
P. Voice--Data Private Branch Exchange (PBX)
Q. Wide Area Networks
R. Teleconferencing
S. Communications Software (e.g., Electronic Mail)
T. Data base/library Search Services
U. User-friendly Operating Environments (computer-aided training)
V. Integrated Software Packages.
W. Decision Support Systems
X. Management Information Systems
Y. Expert Systems
Z. Artificial Intelligence

Table 7. Estimates of How Office Workers Spent Their Time

Actions	Middle Managers 1980	Middle Managers 2000	Professionals 1980	Professionals 2000	General Office Secretaries 1980	General Office Secretaries 2000
Information Intake	19	22	21	24	11	13
Information Production	18	14	16	12	39	39
Database Management	7	8	9	10	13	16
Processing	10	10	21	22	9	8
Information Dissemination	7	6	9	7	15	13
Interactive Communication	39	40	24	25	13	11

Note: The 1980 estimates are based on a review of the literature, relying principally on Lieberman, M.A., Selig, G.J., and Walsh, J.J., Office Automation, John Wiley, New York; 1982; and Engel, G.H., Gropusso, J., Lowenstein, R.A., and Traub, W.G., "An Office Communication System," IBM Syst. J., Vol. 18, 1979, p. 402- . Judgment was required to allocate activities among The Information Handling Actions. "Other" categories are reallocated so that only information work is considered. In sum, these should be considered only as rough proportions of information handling actions.

The year 2000 estimates draw on the proportion of work time calculations (set up in Table 6, normalized to sum to 100%).

Table 3. Technologies Anticipated to Exert a Management Influnece on Each Information Handling Action

	Information Intake		Information Production		Database Management		Processing		Information Dissemination		Interactive Communication		Summary		
	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	1990	2000	Total
A	5	4	5	3	1	1	1	2	2	3	2	0	16	13	
B	5	0	9	0	2	0	1	0	1	0	1	0	19	0	
C	4	0	7	2	3	0	4	0	0	0	0	0	18	2	
D	2	3	8	3	0	2	1	3	0	2	1	2	12	15	
E	3	1	11	0	2	0	4	0	6	0	4	0	30	1	
F	8	0	10	0	6	0	10	0	5	0	5	0	44	0	
G	3	1	3	0	7	0	9	1	2	1	2	0	26	3	
H	5	0	2	0	10	1	5	0	3	0	2	0	27	1	
I	3	0	0	0	7	1	2	0	1	0	2	0	15	1	
J	4	1	0	1	7	4	4	1	4	1	0	0	19	8	
K	2	0	2	1	1	1	2	0	9	0	0	0	16	2	
L	4	3	1	2	2	1	1	0	6	2	3	1	17	9	
M	4	1	3	0	0	0	1	0	11	1	5	2	24	4	
N	4	0	2	0	2	0	3	0	10	0	12	1	33	1	
O	3	2	3	2	1	2	2	2	6	4	6	4	21	16	
P	5	0	2	0	0	0	1	0	7	1	13	0	28	1	
Q	3	1	4	0	1	1	2	0	8	0	8	2	26	4	
R	1	3	0	1	0	0	2	0	2	2	9	4	14	10	
S	6	0	5	0	1	0	2	0	10	0	7	1	31	1	
T	8	2	2	0	4	0	1	0	0	0	1	0	16	2	
U	3	2	4	2	4	1	6	0	1	1	1	4	19	10	
V	3	3	3	1	2	1	6	1	0	1	1	0	15	7	
W	5	3	1	0	3	0	8	1	0	1	1	1	18	6	
X	5	0	4	0	6	0	8	0	0	0	2	0	25	0	
Y	0	8	0	4	2	4	1	10	0	1	0	2	3	29	
Z	1	7	0	6	0	7	1	11	0	2	0	3	2	36	

Note: Of the respondents, one did not differentiate 1990 and 2000. There was great individual variation in how many technologies respondents nominated as exerting a major influence (from a high of 100 to a low of 21). Tally based on 15 respondents.

Comments: The Information Dissemination and Interactive Communication columns are most similar in terms of the technologies perceived to affect these actions. The technologies most nominated as exerting major influences on information handling actions are: image processing, voice recignition, expert systems, and artificial intelligence; followed by broadband local area networks and teleconferencing. The information technologies do not link simply with the information handling actions.

CANDIDATE "OFFICE" TECHNOLOGIES (Please use the letter codes in making entries above. Do not report items already listed for 1990 in the 2000 column. Some have found it easier to take each technology and decide which ACTIONS it could affect, rather than vice versa.)

A. Image Processing
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I. Removable Hard Magnetic Disks
J. Optical Disks
K. Laser Printers
L. Voice Synthesis
M. Facsimile Transmission
N. Baseband Local Area Networks
O. Broadband Local Area Networks
P. Voice--Data Private Branch Exchange (PBX)
Q. Wide Area Networks
R. Teleconferencing
S. Communications Software (e.g., Electronic Mail)
T. Data base/library Search Services
U. User-friendly Operating Environments (e.g. computer-aided training)
V. Integrated Software Packages
W. Decision Support Systems
X. Management Information Systems
Y. Expert Systems
Z. Artificial Intelligence

Table 4. Estimates of Savings Due to Office Automation

Time Required to Complete a Unit Amount of Office Work

[relative to 100% in 1980]

Information Handling Actions	Lowest Value Considered Reasonable (Median)	Best Estimate (25th Percentile)	Best Estimate (Median)	Best Estimate (75th Percentile)	Highest Value Considered Reasonable (Median)
1990					
Information Intake	70	78	80	90	90
Information Production	55	62	70	78	85
Database Management	60	58	78	80	88
Processing	60	65	72	82	88
Information Dissemination	62	65	75	82	85
Interactive Communication	70	72	82	90	90
2000					
Information Intake	50	60	65	78	82
Information Production	40	40	50	62	72
Database Management	40	48	62	68	75
Processing	40	48	50	70	72
Information Dissemination	38	48	50	62	72
Interactive Communication	42	52	65	72	80

Table 5. Estimates of Changes in Office Workload Attendant to Introduction of Modern Office Technologies

Information Handling Actions	Amount of Office Work Per Unit of Organizational Output								
	25th Percentile Values			Median Values			75th Percentile Values		
	Middle Managers	Profes sionals	General Office Secretaries	Middle Managers	Professionals	General Office Secretaries	Middle Managers	Professionals	General Office Secretaries
1990									
Information Intake	118	122	102	130	140	120	140	160	140
Information Production	105	120	100	120	120	120	140	160	160
Database Management	110	120	115	125	140	130	160	160	170
Processing	125	140	105	140	150	120	160	160	160
Information Dissemination	110	112	100	135	120	120	140	160	170
Interactive Communication	100	105	100	120	120	100	135	140	115
2000									
Information Intake	132	155	115	160	160	140	200	200	160
Information Production	120	140	100	140	140	160	160	200	190
Database Management	122	155	140	160	160	160	190	200	200
Processing	150	170	100	180	190	140	200	250	190
Information Dissemination	115	120	90	140	140	135	190	190	215
Interactive Communication	100	100	85	140	150	100	160	160	135

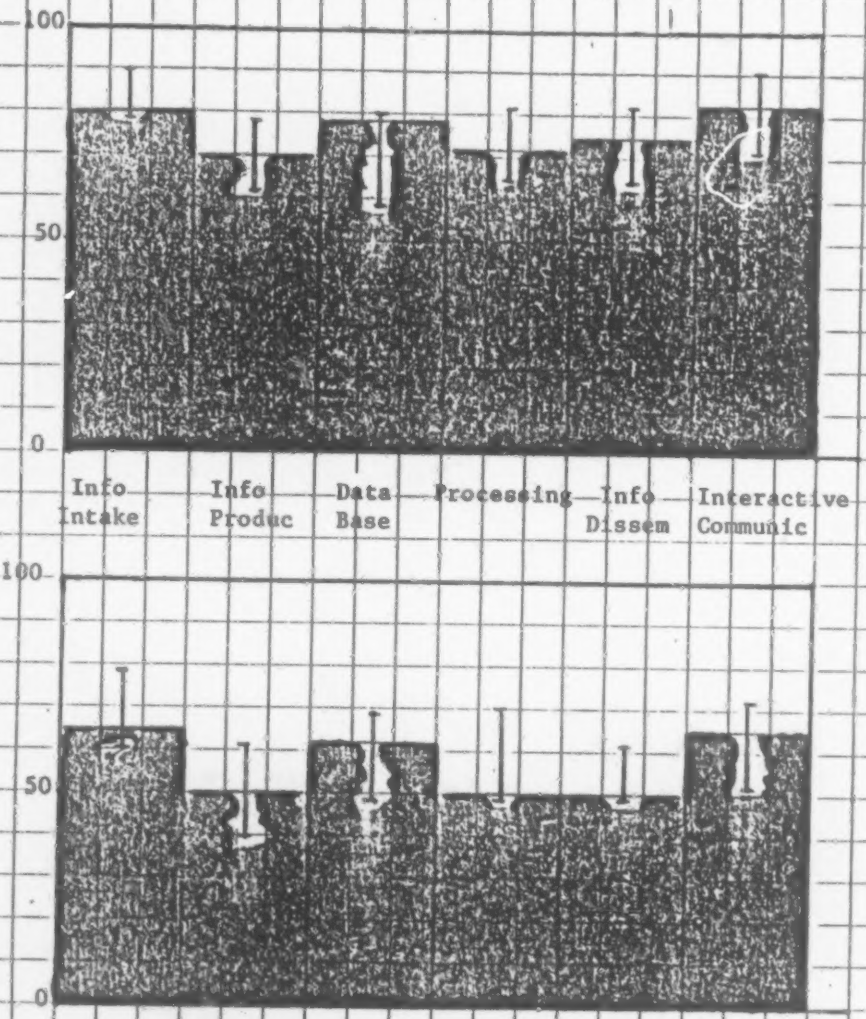
Note: All values derive from 'best estimates.' All values are relative to a base of 100% in 1980. For instance, a value of 140 implies 40% increase in the amount of that information handling action per unit of organizational output.

Table 6. Estimated Labor Demand, Per Unit of Organizational Output

Information Handling Actions		Middle Managers			Professionals			General Office Secretaries		
	Savings	Workload	S*W	1980 Proportion of Work Time	Workload	S*W	1980 Proportion of Work Time	Workload	S*W	1980 Proportion of Work Time
1990										
Information Intake	.8	1.3	1.04	.19	1.4	1.12	.21	1.2	.96	.11
Information Production	.7	1.2	.84	.18	1.2	.84	.16	1.2	.84	.39
Database Management	.78	1.25	.975	.07	1.4	1.09	.09	1.3	1.01	.13
Processing	.72	1.4	1.01	.10	1.5	1.08	.21	1.2	.86	.09
Information Dissemination	.75	1.35	1.01	.07	1.2	.90	.09	1.2	.90	.15
Interactive Communication	.82	1.2	.98	.39	1.2	.98	.24	1.0	.82	.13
Total Information Work			.97			1.01			.88	
2000										
Information Intake	.65	1.6	1.04	.19	1.6	1.04	.21	1.4	.91	.11
Information Production	.50	1.4	.70	.18	1.4	.70	.16	1.6	.80	.39
Database Management	.62	1.6	.99	.07	1.6	.99	.09	1.6	.99	.13
Processing	.50	1.8	.90	.10	1.9	.95	.21	1.4	.70	.09
Information Dissemination	.50	1.4	.70	.07	1.4	.70	.09	1.35	.675	.15
Interactive Communication	.65	1.4	.91	.39	1.5	.975	.24	1.0	.65	.13
Total Information Work			.89			.92			.79	

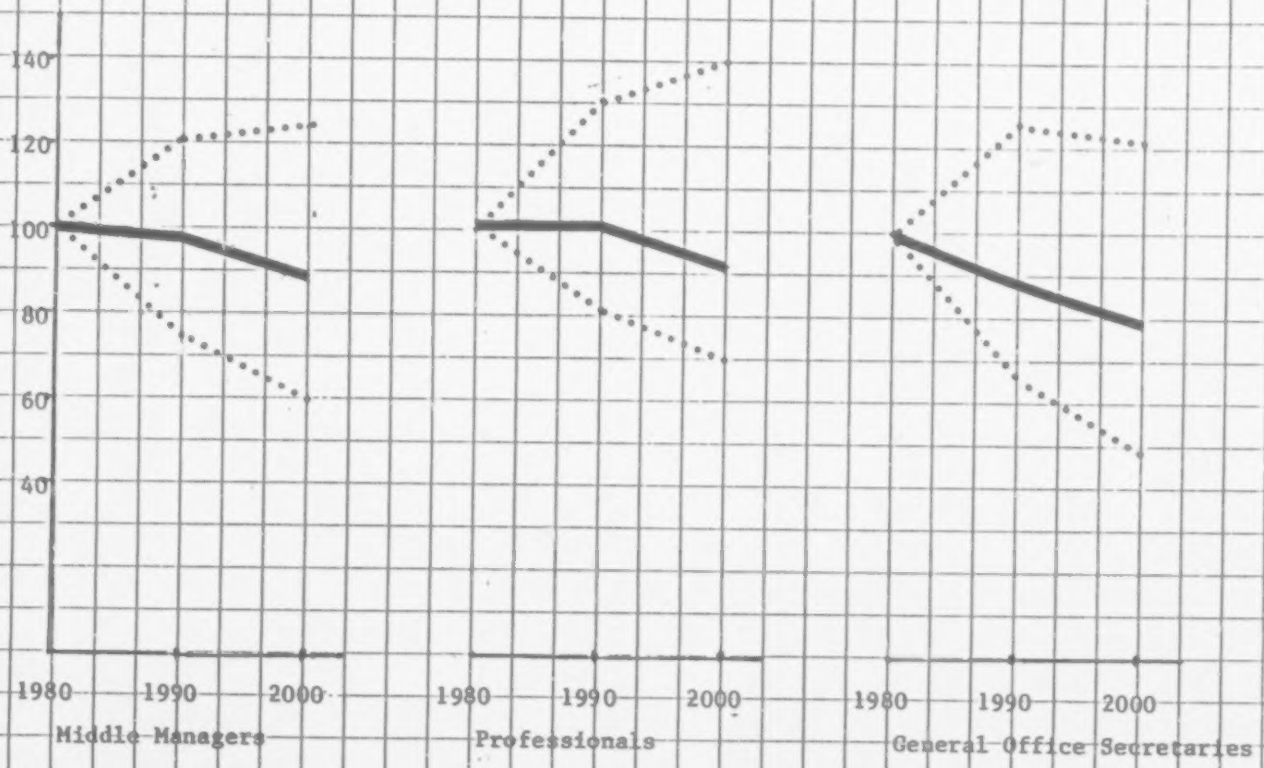
Note: Savings estimates come from Table 4 median, 'best estimates' (as decimals).
Workload estimates come from Table 5 median, 'best estimates' (as decimals).
1980 Proportion of Work Time estimates come from Table 2 (as decimals).

Figure 1. Labor Savings Due to Adoption of Office Technology



Note: The '100' level represents no change in labor productivity from 1980 practice. '50' anticipates doing a unit amount of work in 50% of the time it took in 1980 office practice. The bars indicate the median estimate by our panel of how much time it will take to do a unit of work in 1990 (top) and in 2000 (bottom). The 'I's' indicate the range in which the middle half of the estimates fell. The empty area above the bars indicates the amount of labor savings due to office automation.

Figure 2. Percent of 1980 Labor Demand Per Unit of Organizational Output



Note: The solid curves are the projected labor requirements from Table 6. The upper and lower dotted line curves are calculated in a similar manner, but using the 75th percentile 'best' estimates of savings and of workload for the upper curve; the 25th percentiles, for the lower.

Appendix 1

OUTLOOK FOR OFFICE AUTOMATION TECHNOLOGIES 1985-2000

I. Introduction

A. Purpose

This paper presents an overview of the projected future of technologies relating to office automation for the period 1985-2000 synthesized from a wide range of sources. It emphasizes technological devices and systems that support the information related functions of managers, professionals, and clerical workers in the office environment. In developing this analysis, we first distinguish among levels of aggregation of the technology and among major types of information related functions.

B. Some Distinctions

We distinguish among three levels of aggregation of the technologies to be considered. Components are discrete parts that are combined to make up larger devices and systems. They are not functionally free standing. Examples of components are microprocessors and RAM chips. Devices are organized from components. While they function independently, they are localized. They may or may not be linked to other devices. Examples of devices are microcomputers and stand alone word processors. Systems are composed of devices that are interconnected by some communications medium. Thus systems need not be local. A system is more than the sum of the discrete devices that compose it. Some examples of systems are a microcomputer network linked by a bus and a set of terminal workstations connected in a star that are supported by a central minicomputer.

In considering technology in the office environment as it affects managers, professionals, and clerical workers, we relate it to the actions performed by the workers. For the purposes of this project, we use a six action typology: information production, information intake, information processing, data management, information dissemination, and interactive communication. We believe that the important work-related activities in the office can be partitioned into these six "information actions," and that important technological developments can be described in relation to them.

C. Structure of This Work

In dealing with forecasts of office automation technology, it is important to note that quantifiable parameters and their values over time are most prevalent in the case of hardware components such as microprocessors and RAM chips. For hardware devices and systems and for software, relatively few standard numerical parameters exist and time series data are generally absent. Our analysis will reflect these realities.

This work will present forecasts for 1985 to 2000 for office automation technologies organized by information action. Since the same technology can be involved in different actions, there is no one-to-one correspondence between technologies and actions. We will discuss the various technologies under the actions we believe they are most central in supporting. No technologies centrally relate to information intake so this action will be absent. We will emphasize devices and systems. A final concluding section will deal with systems for office automation and concluding observations.

II. Forecasts of Technologies Supporting Information-Related Office Actions

A. Information Production

1. Overview

Information production refers to the function of taking information that lies outside the office automation system and converting it to an appropriate representation within the system. At present most input to office automation systems takes place through the keyboard. However keyboard technology is now essentially static. Other input technologies are assuming greater importance as their capabilities increase and their prices decrease. These are optical character recognition (OCR), in which printed and written characters are represented electronically within the system; image processing, in which graphics are represented electronically within the system; voice input, in which the human voice is directly represented within the system; and touch sensitive input. The importance of these technologies lies in their directness of input, shortcircuiting any intermediate steps. We will consider these technologies in turn.

2. Optical Character Recognition

Optical character recognition functions to transform text on paper into electronic signals at the input of a system. Optical character readers (OCRs) have not been widely introduced into the office environment because of poor performance/cost ratios in the past. That is, manual entry of text was easier and/or less expensive. The general technique is for the page to be scanned with light. The white or background portions of the page reflect the light while the dark or inked portions absorb it. The resulting image is digitalized and fed into character recognition circuitry. There are two major approaches to character recognition: matrix matching in which the digitalized character is grided and compared to preexisting templates, and feature or shape analysis in which characteristic features are abstracted from the digitalized representation and used to identify the character. Matrix matching works best where the OCR deals with a limited number of type styles with limited variation within each. It is also better at reading slightly degraded print. Feature analysis is most useful where the characters are less predictable as in human handwriting and printing (Brody 1983). OCRs should be more widely adopted in the future because prices are falling (beginning at around $7000 in late 1984) due in part to the rapid decreases in the price of hardware components. A tabletop unit (Dest Model 213) that inputs a page in 15 seconds; automatically recognizes up to 12 typestyles; reads 10 pitch, 12 pitch, and proportionally spaced text; feeds 75 sheets automatically; formats text automatically; and claims an error rate of less than one substitution per 300,000 characters was available in 1984. Omnifont, the ability to learn and read new typefaces, is a capability of high priced systems manufactured by the Kurzweil Corporation.

In Japan the major problem is one of translating the approximately fifty alphanumeric Kana characters into the thousands of Kanji or Chinese characters in common use. Such translation still requires a word processor operator to make the final selection of Kanji characters from a set of homonyms (Amo and Mori 1983).

In principle combining OCR with FAX (electronic transmission of images from hard copy to hard copy) is attractive since OCR involves substantial data compression. However OCR cannot yet handle graphics. When this is achieved, information compression would then allow the FAX transmission to consist of intermixed ASCII code and digitized image bits.

Further development of OCRs rests on increased speed and capability, decreased cost of hardware, and improved character recognition software. Because hardware costs are steadily falling, if there is a bottleneck, it will be in the software. Yet, already single handwritten numbers and parts of handwritten numbers, some quite sloppily written, can be detected with an accuracy of 99% for the single numbers (Shridhar and Badreldin 1984). With the decrease in price and increase in capabilities of OCR equipment it is likely that we will see inexpensive OCR units widely used in offices before the end of the decade (Kay and Powell 1983). It is possible that some systems will be designed to refer uncertain cases to human analysis. Such hybrid systems may simplify the recognition components and thereby reduce costs while maintaining very high accuracy. Further, it is possible that by the middle of the 1990s most handwritten forms will be able to be processed by OCR equipment (U.S.Department of the Treasury,1984). If trends of increasing capability and decreasing price continue, direct input of all sources of visual material will be commonplace in the office by 2000.

3. Image Processing

Beyond the identification of discrete characters, the ability to recognize graphical material is important in the office context. Fortunately, the recognition of two dimensional images are within the capability of the current technology (Kanade and Reddy 1983). Such graphical material is tackled through the brute force approach of identifying and storing the entire form with minimal compaction. As Kay and Powell (1983) note, image recognition will require the increased processing power and storage capacity that is becoming available. Indeed machines with special architectures for image recognition, such as the Cytocomputer at the Environmental Research Institute of Michigan, are being developed (Wallich 1985).

4. Voice Recognition

Another direct input technology which, if widely implemented, will contribute substantially to the automation of information input is voice recognition. Speech creates air pressure variations which are transduced into electrical signals which are then broken down into their component frequencies (Kaplan 1980; Doddington and Schalk 1981). In the processing system, words need to be "time aligned" to compensate for the variations in their length when they are spoken. Substantial success has been achieved in recognizing isolated words using limited vocabularies in a speaker dependent mode, in which the machine is "trained" by the speaker whose voice it is going to recognize. As in the case of visual input, both template matching and feature recognition approaches are used. In the former, the speaker creates the word templates in the system to which the unknown words spoken by the same or another individual are matched. In the latter, the system extracts consonant and vowel features and recognizes invariant relationships among them. The current state of the art of feature recognition systems has a 10% error rate operating in the speaker independent mode (Reddy and Zue 1983).

Continuous speech recognition is a far more complex problem since the acoustic properties of a word are modified by its place in a sentence and by adjacent words. The major current research effort in this area is by IBM. This system interprets office memos using a 5000 word vocabulary of standard English with pauses between words. An accuracy rate of 94% is reported. However, it is both speaker dependent and slow. Directions of its further development include reducing the speaker training requirements for the system (Reddy and Zue 1983).

It is important to note that one of the objectives of the Japanese Fifth-Generation Computer Project is to build a speech activated typewriter with a vocabulary of 10,000 words and the capacity to handle the voice patterns of hundreds of speakers. A voice activated word processor that accepts individually the approximately 100 monosyllables from which each Japanese word can be composed, converts them into Kana characters and feeds them into a Kana to Kanji translator has been developed. Input of 100-200 monosyllables per minute results in 96% accuracy of recognition. This rises to 99.8% with the addition of lexical and syntactic knowledge in the processor (Nitta et al. 1982). While there are substantial problems to overcome such as vocabulary size, speaker independence, cost and speed, and graceful error recovery, Reddy and Zue (1983) believe that systems capable of taking limited dictation might be possible in the mid 1990s if substantial resources are committed. Command recognition systems involving independent words or strings of words out of a limited vocabulary are already in limited use for such applications as inspections and instructions at firms like Lockheed. They are now used in electronic design systems designed by such firms as Calma (Green 1984). Kay and Powell (1983) predict that in the late 1980s such systems may be used for voice data entry applications where a limited vocabulary is used. They also project limited continuous speech recognition systems by the mid 1990s. The main barrier is the cost and effort required to develop the software necessary for the task. Yet it appears that demand is increasing. Sales of voice recognition equipment are projected to rise over 90% per year through 1986 with an almost four fold increase between 1986 and 1990 (Predicasts 1984A).

5. Touch Sensitive Input

Recently another form of non-keyboard input, touch sensitive input, has become commercialized. Some recent Hewlett Packard microcomputers have touch sensitive screens, while the mouse is commonly used on computers in the Apple line. The mouse is a palm sized device that, when moved over a table surface, positions a cross-hair curser on a computer terminal video screen. This positioning is both easy to do and quite accurate. Five basic different technologies are used to sense motion. These are mechanical, mechanical analog, opto-mechanical, optical, and hybrid (Teschler 1984). Touch sensitive screens allow direct positioning of a curser on a screen through direct touch. One approach surrounds the screen with with infrared light emitting diodes and sensors. The touch is sensed by the interruption of the light beams crossing the screen face. The other approach places a resistitive or capacitative layer on the screen that acts as a pressure sensitive switch (Costlow 1984). In many cases touch sensitive input is preferable to keyboard input in speed and convenience.

B. Information Processing

1. Overview

In this section we deal with the information processing activities at the heart of office automation systems. We will briefly touch on component developments as they affect computer capabilities. In general, hardware component developments are marked by rapid increases in overall performance as well as in the performance/cost ratio. The key devices are computers, considered as hardware constructed in a particular architecture supported by software as operating systems, systems programs, programming languages, and applications programs. Computers can be divided into three general sizes and levels of complexity:

mainframe computers, minicomputers, and microcomputers. Each type plays a different and significant role in office automation. Mainframes can support very large data bases and large numbers of terminals. Minis can also support networks of terminals or micros simulating terminals, while micros allow desktop computing power with the possibility of being joined into networks of microcomputers or acting as terminals in nets supported by mainframes or minis. Software is becoming more transparent to the user, in that it requires few specialized computer-related skills, and flexible, in that the same program or software package, such as dBase II or Lotus 1-2-3, may be readily adapted to different purposes. If a bottleneck exists in processing during the period to 2000, it will be in software. Software development is presently an art or craft rather than science or engineering. Before software development will be able to keep pace with hardware development, software engineering, involving repeatability and reusability, will have to be developed to the point where it replaces craft skills.

2. Very Large Scale Integration (VLSI)

In this brief section we will indicate projected developments in hardware components that underlie the important devices and systems for office automation. These developments are due to progress in VLSI by which more capability can be packed in a single chip at less cost with faster operations (Trimberger 1983; Bernard 1982). Simply stated, 16 bit processors are now standard with 32 bit processors becoming readily available. It is reasonable to anticipate that 64 bit processors will be available by 1990 (U.S.Department of the Treasury 1984). However this latter step will be less significant than the move to 32 bit processors (G. Bacon, private communication). Figures 1 and 2 (by Arthur D. Little and Company, from Kay and Powell 1983) detail estimates of introduction times and prices of microprocessors. Random access memory (RAM) chips are both increasing in capacity per chip and decreasing in price. 256 kbit chips are presently available and 1mbit chips are anticipated by the end of the decade (U.S.Department of the Treasury 1984). Figure 3 (Electronic Design 1983) gives an estimate of components per chip, projected to increase to a million by the end of the decade.

3. Computer Hardware and Architecture Developments

The key to hardware improvements is increased speed of processing. This ability supports the more demanding aspects of office automation, such as managing large data bases and artificial intelligence. So far the improvement has come from integration. As more capability is required for processing demands, another approach is beginning to prove useful -- parallel processing. Parallel processing is the simultaneous performance of many operations in different processors. (The discussion of parallel processing owes much to The Committee on Science, Engineering, and Public Policy (COSEPP) of the NAS, NAE, and IOM 1984 and Davis 1983.) The first use of parallel processing took place in the innermost loops of serial machines where a small number of operations were handled simultaneously. Vector supercomputers may be viewed as simple parallel machines specialized to computations dealing with regular patterns of data motion. This sort of machine is a scientific number cruncher estimated to reach peak speeds of 10,000 MIPS (millions of instructions per second) by the end of this decade and 25,000 MIPS by the mid 1990s. Current examples of such machines include the Cray I and the Hitachi 810. Peak speeds are reached when the parallel processing in the inmost loops is operating. For irregular activities, speeds are no more than 20% of peak (COSEPP 1984).

New parallel designs that are presently experimental (see Davis 1983) have longer term potential for increasing processing speeds. These machines may be scalable in principle so that by simply adding parallel component structures without significant redesign, the maximum possible computing speed is increased proportionally. Of course this speed is attainable only when the instructions being executed are such as to exploit this parallelism. The use of identical parts allows for economies of scale in production. Some design alternatives for parallel systems (COSEPP 1984) include single-instruction multiple-data (SIMD) in which processors are given the same instruction but operate on different streams of data. In multiple-instruction multiple-data (MIMD) machines, the processors are driven by separate instruction sets, but are synchronized and able to pass data back and forth. MIMD machines are more capable of dealing with irregular patterns and complex instructions, while SIMD machines are oriented to lockstep number crunching.

Various patterns of processor connection are possible including rings, n-dimensional cubes, and binary trees. Likewise there is a tradeoff between the number and size of processors, ranging from a few very large processors to millions of single bit processors. The former approach maximizes the serial component of instructions while the latter exploits the parallelism of the instructions.

If parallel processing is like a body of people marching in lock step, distributed processing, such as in microcomputer networks, has its analog in a symphony orchestra. Distributed operating systems, such as present nets designed by Apollo Computer Inc., will be more extensively developed. Distributed processing operating systems can take advantage of the unused processing and storage capacity of the micros on a net. In addition to distributed processing, such networking arrangements offer the potential of distributed data bases in which the data is dispersed among the various nodes in the net (Wallich 1983). While the great speed of the very large computers is not available to the dispersed units, these systems offer large computing power shared throughout the system. As such, they appear ideal for office environments where processing capability is required locally and where information input and output takes place in many dispersed locations. To give some idea of the hardware capabilities involved, desktop micros presently have

16/32 bit capabilities. 32 bit processors will be available during this decade (U.S.Department of the Treasury 1984 and Figure 1). RAM chip development will move ahead with 4 mbit chips projected by the mid 1990s (U.S.Department of the Treasury 1984; Kay and Powell 1983). Nets using such micros will offer substantial processing power to the office environment.

4. Software

Software is an area where clearly defined parameters expressing important characteristics are lacking, as are serious, quantitative attempts at projecting developments. Indeed, there are major differences between hardware and software (Bacon 1982). First, the logical complexity of software typically far exceeds that of hardware in most systems. Second, software tends to accumulate over time while hardware is periodically replaced by improved technologies. Third, software is involved with the total workings of the institution in which it is involved, while hardware remains localized to that part of the organization that deals directly with it.

Software is divided generically into two types: systems programs and applications programs (Bacon 1982). Systems programs, such as operating systems and systems wide utilities, relate to the internal control and functions of the computer system as a whole. Applications programs relate to specific functions that the computer systems may perform for users.

Over the years operating systems have evolved from the control of single machines through sequential batch processing to systems that offer the possibility of time sharing in which a number of users interact with a computer simultaneously. In this case the system resources are divided and scheduled among the users. Developments in operating systems are moving in the direction of greater flexibility and intelligence, exploiting parallel and distributed processing where appropriate. Multitasking in personal computer operations is advancing (Guterl 1985). Systems that are able to deal with multi-media input and output devices, both for data and for instructions, will become common. As a general rule, operating systems will shed many of their current applications-related functions and become more transparent to the user. By the end of the 1990s operating systems will become completely self-sufficient (Kay and Powell 1983).

In the micro-based environment, the principal current operating system families are CP/M, MS DOS, and UNIX. Kay and Powell (1983) forecast that these families will survive as competitors into the 1990s, while U.S.Department of the Treasury (1984) forecasts that UNIX-based systems will become dominant by 1990. Although, as shown in Figure 4 (from Lewis 1984), UNIX usage is increasing, it is not yet clear whether it will be the dominant operating system by the end of the decade (Lewis 1984). The strength of UNIX lies in its communciations and time sharing, while it lacks transparancy to the non-technically minded user (Kernighan and Morgan 1982).

Both systems and applications software will become more sophisticated and transparent to the user during the period to 2000. The key to progress in systems and applications software will be the development of artificial intelligence (AI) which will be discussed later.

Applications software will emphasize the integration of different data types and functions in the same package (Chang 1983; Brown 1983). The current set of software packages, such as dBase II and Symphony, are initial efforts at the integration of programs designed for office applications. Such programs can become more comprehensive by taking advantage of the greater internal memory now available (Guterl 1985). Symphony, for example, contains spreadsheet, data base, graphics, word processing, and communications components. Obviously it would be desirable if one applications software package were all that was required for the individual user. Emphasis on communciations will increase so that packages containing communications software will become more important.

Software production will more and more emphasize an engineering approach as opposed to the present craft approach. In a survey of software engineering practices in the U.S. and Japan, Zelkowitz et al. (1984) found little use of software engineering in either country. They noted that the Japanese firms often use techniques developed in the U.S. and that their emphasis is on practical tools. Present software is typically unique, without interchanegeable modules or parts. It has been described (Bacon 1982) as a bowl of spaghetti as contrasted to a set of building blocks with well defined interfaces. Thus, its ability to be altered or even maintained is restricted. This lack of clear structure is especially acute when programs must interface with one another. Thus, as a beginning, programs will be written in "structured languages," that is languages that can readily produce programs that look like a structure made up of clearly defined building blocks. Software engineering is a field that is generating much current interest as evidenced by the Department of Defense's recent establishment of a Software Engineering Institute at Carnegie Mellon University. Engineering techniques that have been applied, and will be applied more frequently, to the efficient production of software include rapid prototyping, to enable the user to review the system before an enormous amount of time and effort have gone into its construction; the use of very high level languages; and building programs from reusable modules. The use of software engineering will continue to become more and more important as software becomes more complex (Ramamoorthy et al. 1984).

5. Artificial Intelligence

Artificial intelligence (AI) is currently a popular buzzword. It refers to computerized systems, usually software written in the languages LISP or PROLOG, that perform functions that are normally associated with "intelligence." One primary product of AI is expert systems. These are software packages that incorporate human expertise in order to deal with the complex situations that human experts confront. Current examples of expert systems include medical diagnostics, computer system configuration, and mineral exploration. In some cases they have proven to be technical and financial successes. AI is beginning to be applied to software engineering in such areas as intelligent editors and tutoring aids for beginning programmers (Musa 1985). In the office context AI may at some point help in such areas as synthesizing data, composing reports, and decision support.

The key components of AI systems are knowledge bases and reasoning elements or inference engines. The knowledge bases are composed of data and insight typically associated with human experts. Knowledge acquisition is presently the principal bottleneck in constructing knowledge bases (Feigenbaum 1983). Presently the AI worker must enter each piece individually. Gathering knowledge by machines using human-like strategies does not presently exist. Structuring the knowledge base is also a craft activity (Hayes-Roth 1983). Each individual case is unique; there are no general approaches. Feigenbaum (1983) predicts that heuristic approaches to knowledge acquisition should be developed by the 1990s. His view is to focus on relatively specialized systems since the development of generalized systems has historically been a resource consuming trap. Hayes-Roth (1983) notes that current knowledge engineering or knowledge base building tools are presently not of commercial quality or portable.

Because AI is an important part of the Japanese fifth generation computer project and subsequent developments (see, for example, Ouchi 1984), it will receive substantial emphasis throughout the world over the next decade. Projections (U.S.Department of the Treasury 1984; Kay and Powell 1983; Feigenbaum 1983) suggest a substantial improvement in the design and implementation of individual knowledge based systems by the mid 1990s. By the late 1990s these systems will become more integrated and be a central part of the operations of the more powerful computer systems and networks. It is projected that AI sales will increase by two orders of magnitude to $2 billion between 1984 and 1993 (U.S.Department of the Treasury 1984). This will likely be the result of the increase in processing speed and storage at the same cost on one hand, and the development of more efficient processing heuristics on the other. AI developments are of great importance since they have the potential to shift the human and machine roles in computer systems dramatically, both in the operation of the systems and in the effective development of applications.

C. Data Base Management

1. Overview

Data base management involves, besides processing hardware, mass storage devices and the software for managing the system. General trends in mass storage devices include technological developments that offer increased storage at decreased unit cost with fewer errors. As computer networks develop and become more sophisticated, distributed data bases should come into being (Wallich 1983). The ability to manage such resources effectively to get needed information and to modify data bases without interfering with other network processors is a research goal.

2. Mass Storage Devices

The principal mass storage media are presently magnetic disks, as tape is relegated more and more to purely archival uses. Magnetic disks exist in two forms: hard and flexible or floppy. Mainframe computers presently rely on hard disk storage with disk packs in excess of a gigabyte (a billion bytes). Microcomputers typically use 5" or 3" floppies with storage capacities in excess of 500 kbytes. An important trend in the improvement of storage media is increased capacity through increased storage density so that within a few years 200 mbyte 5" hard disks are likely (U.S.Department of the Treasury 1984). Accompanying the increased density is decreased cost, estimated by Kay and Powell (1983) to fall from 0.4 millicents per bit in 1982 to 0.01 millicents per bit by 1997. Access times are projected by the same source to fall from 25 msec in 1982 to 10 msec in 1997. The removable hard disk is beginning to be used more widely as a storage medium in microcomputers, and its capacities are increasing. The trend to more economical, accessible, and compact storage should act as a supply side driving force to the development and maintenance of large data bases.

The major technology that will be competing with magnetic disks as a storage medium is optical disks (Goldstein 1982). This medium offers lower cost and higher capacity than magnetic disks. However, at present, optical disks have one major disadvantage. They may be written on only once, and are not erasable. At costs per storage unit and access times at least an order of magnitude more favorable than magnetic disks, they are an excellent medium for archival storage (Kay and Powell 1983). With erasable optical disks anticipated by the end of the decade, their role may be enlarged substantially since their capacity is projected to be greater than that of magnetic disks, above 100 gbytes by the early 1990s (U.S.Department of the Treasury 1984; Lineback 1983).

Magnetic tape remains widely used as archival storage. However, tape must be accessed sequentially and, with the coming of video disks, it may play a decreasing role as deep archival storage.

3. Data Base Management Software

With the increased speed and decentralization of processing and the increase in storage capabilities and performance, data base software should play a major role in assuring that these capabilities are used to their fullest. The organization of a data base management system determines both its user friendliness and the efficiency of its performance. A tradeoff is involved between relationally structured data bases on one hand that are user friendly, slow, and require large amounts of storage, and network and hierarchical data bases that require more sophisticated users, but are more efficient and require less storage. A compromise is to interface a network system with a relational system to reap the benefits of both, but with the costs of both (Computer Decisions 1984).

Foundation systems are systems that can be used to integrate data base systems with other applications. These systmes again involve tradeoffs between the added capabilities of a multi-function package and the added complexities it involves.

The distributed data base, where the data is spread among a number of storage locations in a network, has not yet been fully perfected (Computer Decisions 1984). For example, one user can be downloading data while another is loading new data. If one node of the net goes down, the user may be unaware that data is not being accessed. Yet the flexibility and advantages of distributed data bases are such that interest and further developments should continue. In addition, the micro-mainframe connection (Ferris 1984) will continue to be improved to exploit the potentials of interaction with data bases through connections with mainframes.

Kay and Powell (1983) forecast developments in data base management systems (DBMS) through the late 1990s. By the late 1980s DBMS will be able to extract and summarize data for analytic and decision support. They will be able to manage geographically distributed data bases. Text, voice, and graphic information can be integrated with the data base to be accessed by query and report generation routines. By the mid 1990s users will be shielded from the data models used in the data base and will access it through high level queries and report generation routines. Data dictionaries, lists and locations of the data files available, will become integral parts of DBMS. Hardware assists will be used to simplify the systems, reduce their size, and increase their functionality. By the late 1990s world-wide distributed data bases will be possible.

D. Dissemination

1. Overview

Output technologies lack the glamor of some of the other technological areas being addressed. However, the integration of many forms of output media (including print, graphics, and voice) offers the user a wide range of options in disseminating the output of the computer. Image reproduction, handsome graphics, and voice mail are some of the areas where developments in output technologies will advance the current state of the art through digitizing voice and image signals and reconverting them to output form. In visual displays, color is improving along with resolution. Flat panel displays are being used in some situations. Voice synthesizers are improving. The application of laser and fiber optics technologies has improved the process of image formation (Kay and Powell 1983).

2. Display

The technologies of interest here are the CRT, the most widely used technology, and flat panels, which are becoming more widely used. The areas of concern are size, cost, resolution, and color. We summarize the analysis of Kay and Powell (1983).

The current CRT is inexpensive (some less that $100), has moderate (512x512) resolution, and offers color capability in sizes ranging from 12" to 30". CRTs are being made so that they consume less space.

Flat panel displays (such as the current liquid crystal technology) of 10 or more square inches should be available by the late 1980s at a cost of less than $300. Their resolution will improve, and with their flat profile, they may prove attractive in many applications.

Interest in three dimensional imaging has generated some research. However, this technology will probably not play a major role in the time frame of interest.

3. Hard Copy

Impact printers at the low end of the market are dot matrix. Improvements in cost and quality are occuring steadily. However, most new developments are in non-impact printers. Laser printing systems are capable of producing as much as 10,000 sheets of hard copy per hour. Costs of such units are falling, and units with color capabilities should be available by the late 1980s. Ink jet technology has also been used in both high and low end printers, and its use is becoming more widespread ([illegible] 1983). Difficulties in complex applications are being worked on so that continued improvement is forecast.

Three dimensional imaging technology is also receiving some attention. However progress has been slow, and it is anticipated that this technology will not be a major influence in our time frame.

4. Voice Synthesis

Progress in speech digitalization and compression and the falling costs of voice synthesizer chips mean that this medium will be commonly available by the mid-1980s. Its main applications are in limited warning and status reports and, with additional progress in digital speech compression, in voice mail.

E. Interactive Communication

1. Overview

Interactive communications play a central role in the office environment. When not conducted face to face, these communications need to be supported by technology. Interactive communications within the office environment are based on the network that transmits voice, data, text, and images. The local area network (LAN) provides communications within a building or a group of buildings. The principal present alternative to the LAN is the private branch exchange (PBX). From local area to local area, long distance communications, such as phone lines or satellite relays, carry the traffic. Progress in fiber optic communications has been rapid. For example, AT&T's San Francisco to Bakersfield 90 megabit per second interoffice fiber system was capable in 1984 of being upgraded to 400 megabits per second (Green 1985). Standards for local and wide area networks are being developed (Bell 1985). Our treatment will emphasize the local environment since such communications are most central in office activities.

2. Local Area Networks

The local area network is the technology concerned with the electronic transmission, receipt, and exchange of information within a local area (International Data Corporation 1983). The primary options for local network transmission are the broadband CATV-like coaxial cable, the baseband coaxial cable, and twisted pairs of wires.

Twisted pairs of copper wires are the simplest and least costly form of connection for LANs. These are readily available and provide reliable point to point communication at speeds up to one megabit per second over a distance of one kilometer. The distance limitation is due to the fact that signal strength decreases rapidly over distance (International Data Corporation 1983).

Baseband coaxial cables offer a single high speed digital channel that can be shared by up to hundreds of users. Bandwidths may be up to 50 mhz. depending on the type of coaxial cable used. Baseband's strengths include a simple connection that is easy to increment, a high speed channel, a well known technology, and low cost. Its weaknesses include that it can only support a single function and that voice and video are difficult, if not impossible, because of the limited bandwidth (International Data Corporation 1983).

Broadband coaxial cables offer a series of channels that can be used for multiple applications including voice and video. Data transmission rates in each channel are lower than baseband. However the combined data rate in all channels is higher than baseband. Broadband's strengths include well tested CATV components, 300 mhz. bandwidth available, multiple segregated channels, independent channel protocols, support of up to thousands of users. Its weaknesses include the need for a skilled support staff, potential cumulative noise interference, complex RF technology, and higher costs than equivalent baseband (International Data Corporation 1983).

There are four basic topologies of a LAN. The star has a central hub with all nodes radiating from it. In the hierarchial topology, there is a subdivision of two or more paths for each node with nodes connecting to them and so on. A bus has a common communication path to which all nodes are connected. In the ring each node is connected to two nodes in a circle with transmission in one direction (International Data Corporation 1983).

Local area nets are being developed to meet specific user needs (Dahod 1983). Major present net configurations are both broadband and baseband. By the end of 1982 about 16,000 LANs were installed worldwide (International Data Corporation 1983). As shown in figure 5, workstations on networks are expected to quadruple from about 200,000 in 1984 to about 800,000 in 1987 (Patterson 1984). Key and Powell (1983) anticipate the combination of digital PBXs with LANs by the early 1990s. PBXs will be discussed in the next section.

3. The PBX

The principal alternative to the LAN is the PBX. Many potential LAN users already have PBXs. Modern, digitalized PBXs can handle both voice and data communications. Generally, LANs have greater capacity, greater expansion potential, and more speed than PBXs. However, PBX installations, working from a preexisting system, are often cheaper. Some PBXs currently under development make use of both circuit and packet switching and integrate LAN as a standard feature of the PBX (International Data Corporation 1983; see also Mayo 1982).

Any realistic long term solution to the problem of interactive communication will have to integrate voice, video, data, and text. The LAN and the PBX in their present forms would require substantial integration and improvement before they can deal with the demands of communications that the office environment places on them. One approach (Strategic Inc. 1984) is to use broadband LANs as backbones for baseband systems instead of as separate nets. Strategic Inc. (1984) also projects that users will consolidate existing baseband and broadband LANs into larger nets using optical fibers.

III. Office Automation Systems

The purpose of this section is to integrate the device and simple system technologies discussed in the previous sections into systems to illustrate the functional capabilities and potential of office automation systems to 2000. In many organizations the problem of integration appears as the need to relate electronically the functions of various units of different purposes which were typically made by different manufacturers without, in many cases, consideration for the need of integration. Fortunately integration itself does not mean connecting everything to everything. Yet the basis of any effective integration remains a basic understanding of the functions and operations within the office environment. Thus the problem of integration can be viewed from two extreme perspectives. The first is the bottom up incremental approach of interconnecting existing devices to create a system that is greater than the sum of its individual parts. This approach runs the risk of the technology driving the office functions rather than being determined by them. This incrementalism may not lead to a solution that is particularly effective in the long run. The alternative approach is top down. Here the technology is imported to meet the basic functions. However this approach runs the risk that the new technology will make a major, discontinuous change in office routine that will prove disruptive and confusing (International Data Corporation 1982).

Integration has a number of dimensions. These include: physical link-up, formats and protocols, information types, and applications systems (International Data Corporation 1982).

Physical link-ups involve the physical transfer of information among devices. This is typically done electronically through a PBX or an LAN. Sometimes the transportation of information storage media, such as removable magnetic disks, serves as a link.

Information exchange among different devices requires communality among coding, formats, and communications protocols. Alternatively, conversion hardware or software may be used.

Different information types need to be handled in the same system. Hitherto, data and text have been the principal types. However audio, facsimile, and graphic information are becoming more important. Thus future integrated systems should have the capability of handling all these forms.

Finally applications systems need to be able to integrate all these forms of information within the same applications package. This latter is a goal which has only been partially achieved in such current programs as Lotus Symphony.

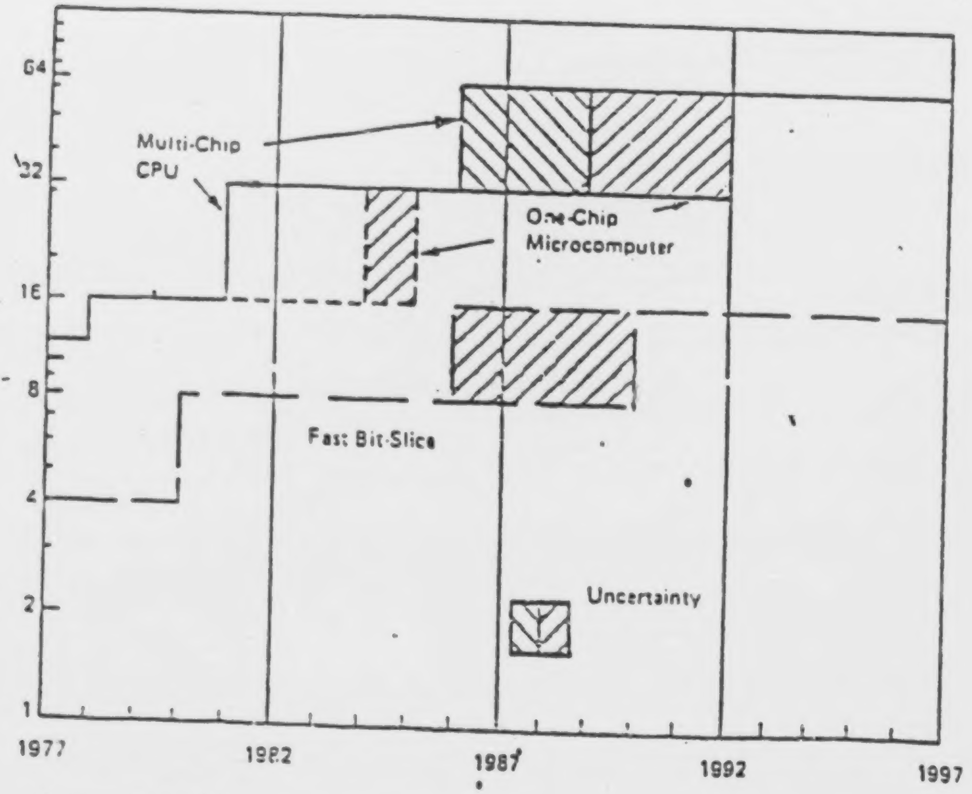
At present office automation systems are made up of a number of terminals, or microcomputers which can act as terminals, sometimes into the hundreds, networked to and supported by a central mainframe or minicomputer (Murphy 1983). Indeed the proliferation of microcomputers has been a demand factor for mainframes to act as hosts for messaging, conferencing, and large data bases (Aupperle 1985). The principal functions of these current systems are: word processing, electronic mail, decision support, administrative support, records processing, electronic filing, data processing (including graphics), and voice mail. Functions that may be added in the future include text display, phototypeset composition and printing, and full integration with data processing functions.

No extant system has a full complement of the currently available functions or complete integration of the ones it has. These office systems are strongest in routine and mechanical activities and weakest in activities requiring intelligence. For example, the area of administrative support is presently built around the personal calendar of an administrator. Decision support functions vary greatly from system to system and are not well integrated. From the managerial/professional perspective, the present systems save time that would be devoted to mechanical functions and communication, but they do not provide very much assistance in judgment and decision making. Thus they are closer to the clerical level. Yet the potential for progress based on the development of integrated packages is clearly perceived. Recent forecasts (Predicasts 1984B) anticipate an annual increase of 40% in shipments of executive workstations through 1990, indicating their expanded use.

We now discuss functional changes in office automation system capabilities that will enter the scene between now and 2000. The individual work station will gradually evolve to the point where it will be based on powerful 32 bit microprocessors with local removable storage of the order of high megabits or low gigabits. The use of this substantial capacity will be frustrated by the relatively slower development of software capabilities of intelligently structured operating systems and applications software. In particular the rate of the development of software possessing intelligence will increase, but not fast enough to fully exploit the hardware capabilities available before 2000. These microcomputer-based work stations will be connected in LANs, with broadband being the dominant network mode, estimated to be 55% of the market by 1988 (Strategic Inc. 1984). For some applications not requiring massive, high speed data traffic, integrated voice/data PBXs will compete with the LANs. Optical fibers will become the preferred physical medium. Transmission speeds will increase substantially. Fully distributed operating systems that take advantage of the resources of the entire system to achieve more efficient processing will be more of a reality. The system inputs may be from voice, printed copy, keyboard, or possibly video. The outputs will be display, hard copy, voice, facsimile, or possibly video. A key change is that developments in artificial intelligence will render the system more transparent to the user so that most instructions can be given verbally in ordinary language or by touch. Mathematical and statistical support, data entry and synthesis, and report generation are among the features that are available integrated in applications packages that can process simultaneously and integrate the various forms of information. By screen or voice the machine can interact with the user on many problems in the office routine, accepting routine verbal instructions and providing verbal or printed output.

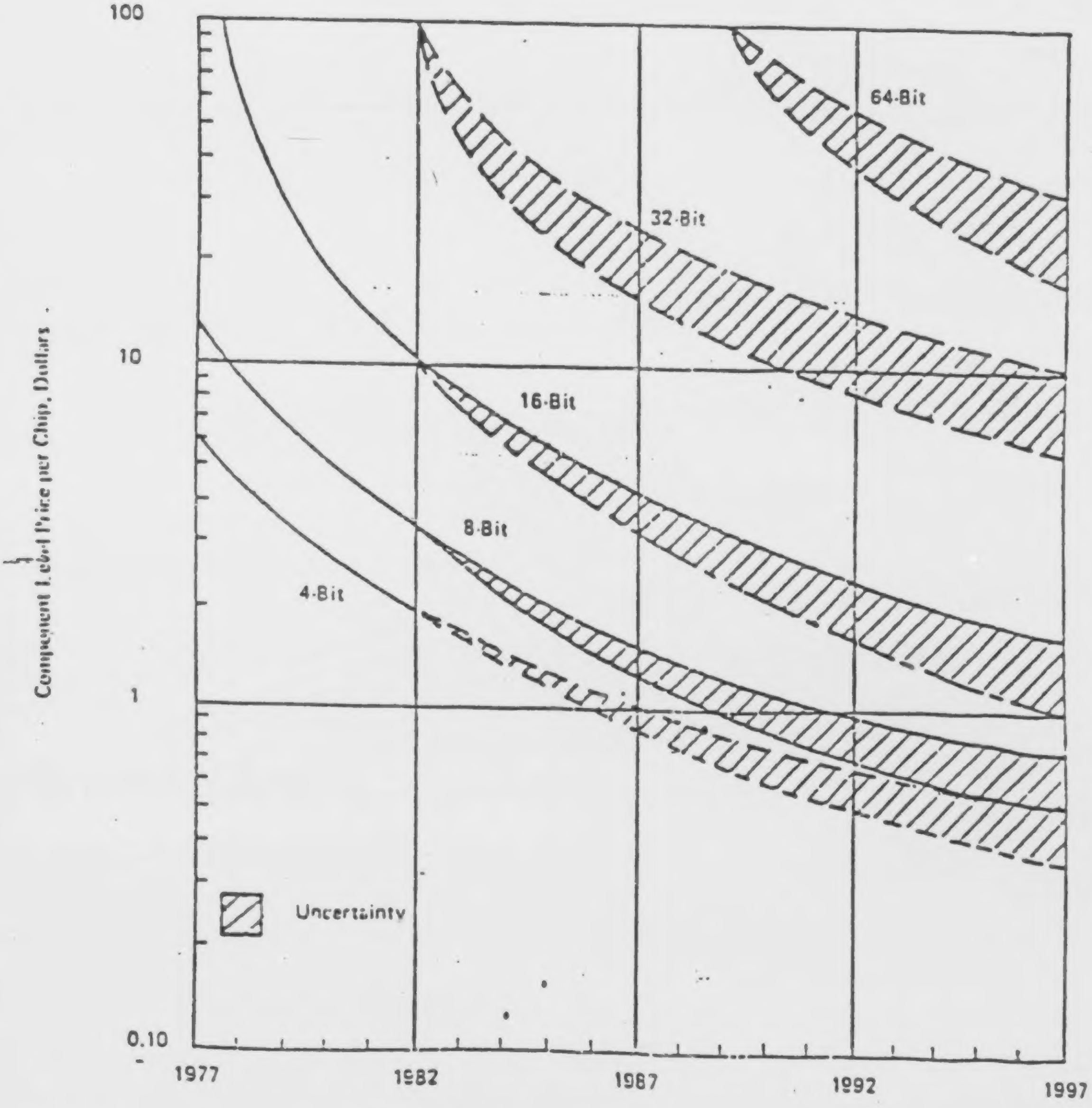
In sum, the following areas are those where the most improvement will occur in office automation systems to 2000:

1. Massive, rapid increases in performance capability and performance/cost ratios of computer hardware;
2. Further improvement of voice, text and video related input and output components;
3. Substantial development of intelligent, transparent software;
4. Further systematic integration and enhanced communications capabilities of office automation systems.



Source: Arthur D. Little, Inc., estimates.

FIGURE 1: MICROPROCESSOR BIT CAPABILITY VS YEAR OF INTRODUCTION (FOR ONE- AND MULTI-CHIP ARCHITECTURES)



Source: Arthur D. Little, Inc. estimates.

FIGURE 2: MEDIAN MICROPROCESSOR PRICE VS TIME
(1000 UNIT PURCHASE)

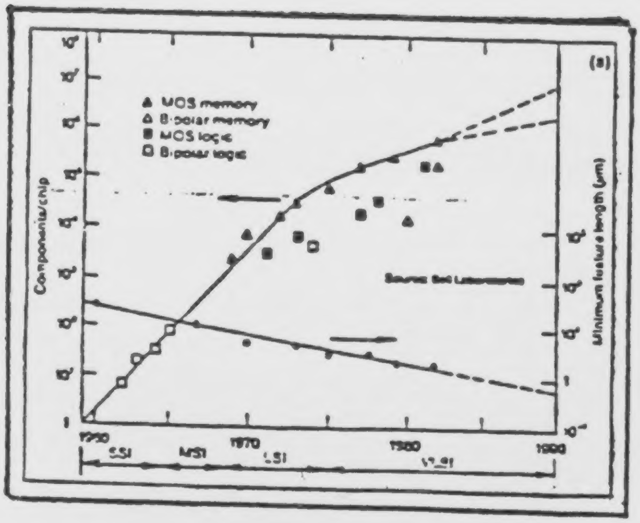
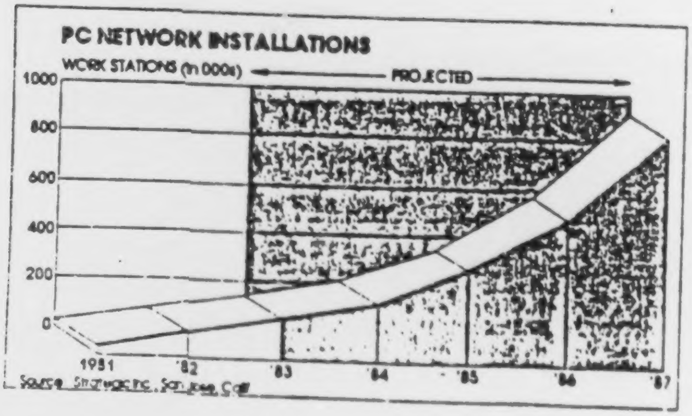
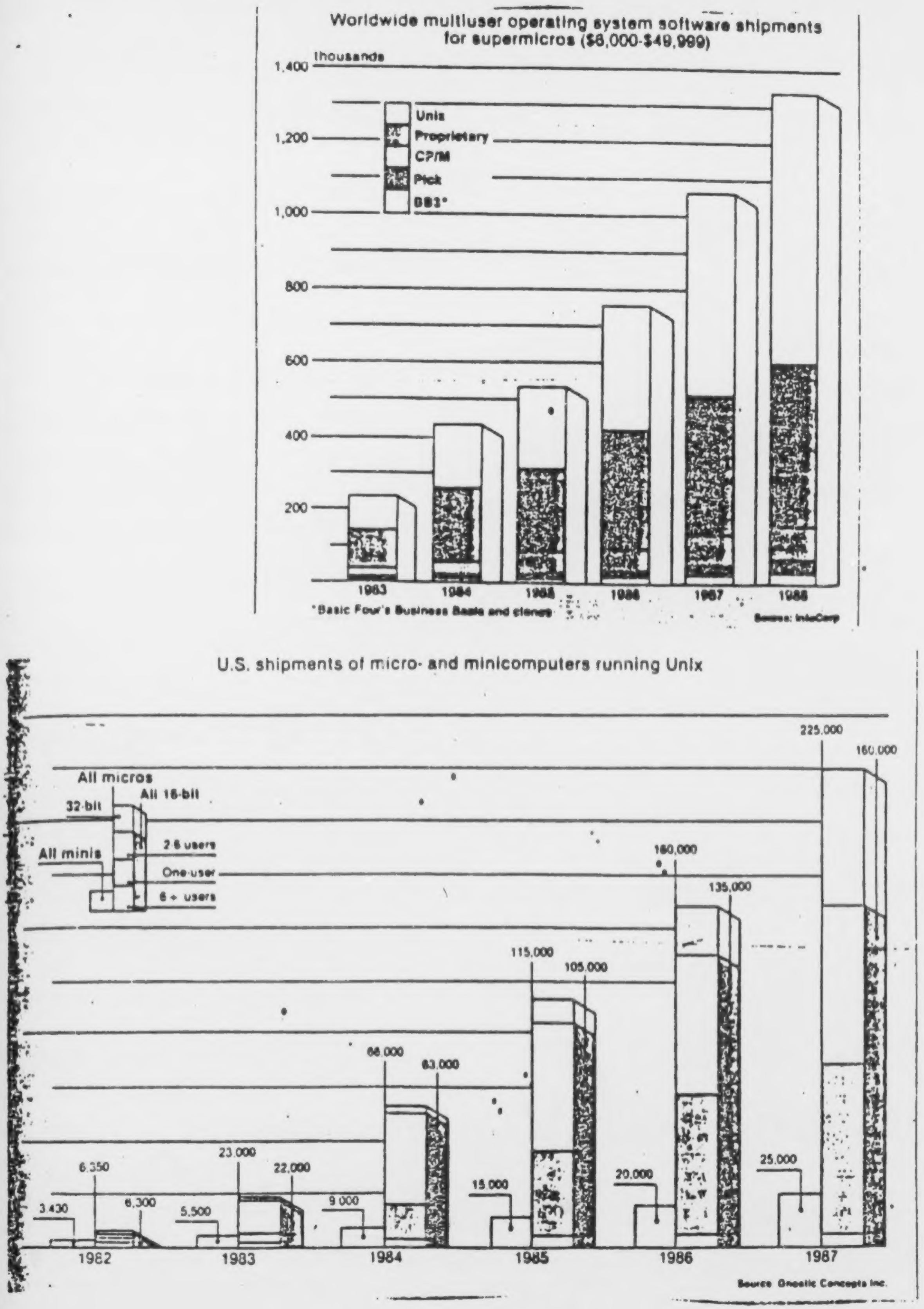


Figure 3 : Components/Chip
(From Electronic Design, January 6, 1983, p. 104)



Source: Strategic Inc., San Jose, Calif.

Figure 5 (From Patterson 1984)



*Basic Four's Business Basic and clones

Source: InfoCorp

Source: Gnostic Concepts Inc.

Figure 4 (From Lewis 1984)

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Appendix 2

MARKET PENETRATION OF OFFICE AUTOMATION EQUIPMENT: TRENDS AND FORECASTS

J. D. Roessner
November 1, 1984

Introduction

Decisions to invest in office automation should reflect the decisionmaker's careful weighing of a myriad of factors that will determine the investment's payoff. The relative importance of these factors will vary over time and with each decisionmaker. If one could forecast the level of investment directly--say, by extrapolating past trends or by relying on seers--then one need not be concerned with the ingredients of the decision calculus. The complex weighing of factors such as the relative cost of capital and labor and the behavior of competitors will have been accomplished "invisibly." Yet this is a big "if." Trend extrapolations may prove valid when they deal with relatively stable phenomena such as the cost and performance parameters of electronic components, but their validity is reduced substantially when they are applied to extremely complex situations, such as market penetration, subject to the influence of many variables whose future values are highly uncertain. Our approach to the problem is to rely on estimates of experts who have been presented with detailed, carefully prepared materials that describe the context in which office automation technology enters the market and the factors that will influence the rate and pattern of its use. In this working paper we

- present a list of factors likely to influence the market penetration of office automation equipment;
- discuss how each factor is likely to affect market penetration over the period 1985-2000 and, where possible, present data on past trends and forecasts of these factors;
- examine historical trends in office automation use and in the values of variables expected to influence use;
- describe and compare a number of available forecasts;
- analyze these forecasts in light of the previous discussions of expected trends in factors that will hasten, constrain, or shape the use of office automation technology.

Factors Likely to Influence the Market Penetration of Office Automation Equipment

Costs of Capital and Labor

Equipment purchases can be financed externally or can draw upon internally generated funds. Office work traditionally has not been heavily capitalized (currently 85% of office costs are labor), but the level of capitalization per office worker is increasing rapidly in some nonmanufacturing industries and will grow rapidly as office automation proceeds. The real cost of capital is reflected in interest rates charged by banks minus the prevailing inflation rate; one indicator of the amount of capital available internally (at least in private firms) is the level of industry profits in immediately preceding years. Past trends in these indicators can be compared with trends in investment in capital equipment by industry and a judgment made about the strength of any relationship.

The rate of capitalization will be influenced to some extent by overall wage levels. As the impact of office automation shifts from clerical to managerial functions, overall wage levels in the economy, not just clerical wages, will be relevant. However, a decision to automate an office function is not a simple tradeoff between the cost of the equipment (and its implementation) and the wages paid workers who perform that function. Instead, it is increasingly clear that firms do not invest in office automation simply to reduce labor costs or increase efficiency (Curley and Pyburn, 1982; Kettinger, 1983). As the International Data Corporation put it,

"Justification for office systems can come only in part from direct labor savings. The rest must come from better turnaround times, increased responsiveness to customers, and smarter decisions" (IDC, 1983: 102).

They punctuate this comment by estimating that an expected level of investment in office automation of $195 billion over the period 1983-1987 will yield labor savings of only $110 billion.

Availability and Cost of Skilled Labor to Use Office Automation Equipment and to Train Others to Use It

Expenditures for office automation must include the wages of skilled operators and trainers. Various sources seem to agree that implementing office automation equipment costs at least as much as the equipment itself. Implementation costs include training costs, labor displacement costs, the cost of reorganizing work procedures, and the cost of support hardware. Other support costs continue as implementation ends due to equipment maintenance, software updating, and ongoing training activities. Past trends in industry (and government) expenditures for training offer some guide as to what levels might be expected in the future. The availability of workers possessing the requisite fundamental skills such as analytical sophistication, problem solving, ability to synthesize disparate materials, and communicate effectively could place serious constraints on the pace of market penetration. Industry representatives in our previous study (Roessner, et al, 1984) agreed that all office workers, managers and clericals alike, will need to acquire numerous new skills that are not now needed to perform their duties.

Industry Structure and Competitive Environment

The rate and pattern of market penetration of OA equipment will vary widely across and within industries. These variations will be a function of the marketing strategies of vendors and a host of factors that influence the spread of innovations (Brown, 198). Several interindustry and intraindustry conditions that will shape market penetration are discussed here. The effects of marketing strategies and of macroeconomic conditions, while potentially significant, are excluded from this discussion.

Very little empirical literature exists on the structural factors that influence the diffusion of innovations in nonmanufacturing industries. The following discussion draws upon Nelson, Peck, and Kalachek (1967), Mansfield, et al (1977), Utterback (1974), and Nelson and Winter (1977), and the author's synthesis of a wide range of literature on the process of technology diffusion (Roessner, 1979).

1. The contribution office work makes to the industry's production or service delivery function. Indicators of the significance of office work include the proportion of the industry's employees who are white collar workers, the ratio of total white collar wages to blue collar wages, or the ratio of office costs to total costs of doing business. As Figure 1 shows, office work, and workers, are concentrated in the finance, services, and trade industries and government. On this basis, we would expect OA to appear initially in the wholesale trade and finance industries. Within white collar industries, those with a relatively large proportion of clerical workers have been the first to automate because of the initial emphasis on automating clerical functions. The popular and trade literature indicate that banking and insurance have been the bellwether industries for OA.

2. Whether firms in the industry compete primarily on the basis of the price of the product or service delivered, or on the basis of the type, variety, and quality of product or service. In a typical manufacturing industry, new production technology displaces human labor in order to reduce the costs of production. Here, automation is justified on efficiency grounds. The cost of production declines as the amount of capital per worker increases, and firms compete on the basis of product price. In many service industries, in contrast, competition is based as much on the quality and range of services delivered as on price.

Thus, automating an existing task is less important than enabling new tasks--services--to be performed. The (initial) cost of providing a product or service may actually increase as technology is added to production or service delivery processes; rather than displacing workers, technology largely complements their activities. Labor cost savings, already only one of several rationales for the purchase of OA equipment, will decline in importance as managerial, technical, and sales jobs become increasingly automated. Under these conditions, a firm that automates may force rapid adoption of OA equipment among its competitors even if the new equipment generates net losses. (A case in point is automated teller machines, which initially did not prove profitable for banks but which have spread rapidly. Another is American Hospital Supply, Inc., which increased its market share dramatically by installing terminals in hospitals linked to its sales organization.)

In sum, because the payoff to the firm from OA will not be manifested entirely, or perhaps even primarily, in cost savings from reduced labor requirements, we expect market penetration to occur more rapidly in industries that compete on the basis of product quality than in industries that compete on the basis of product/service price. Clearly, analysis is needed of the role that OA plays relative to other factors in enhancing a firm's competitive position.

3. *Industry Structure*. All other things equal, we expect that the reduced competitiveness of monopolistic or oligopolistic industries, and of industries comprised of widely dispersed, small firms that do not compete directly, would yield slower response to the promise of OA. Regulated industries probably will vary widely in their response. Early experimentation with OA is likely to occur even in monopolistic industries such as utilities, provided slack (uncommitted) resources are available within the firm. But in the absence of competitive pressures, we believe that this experimental stage will continue well beyond the time when more competitive industries become committed to office automation. When airfares were regulated, competition based on service delivery encouraged the introduction of computerized reservations; more recently, computerization of "frequent flyer" records occurred for similar reasons. In both cases, automation was introduced under conditions of constrained competition when a very specific application was evident. Additionally, industries dominated by small firms are likely to move more slowly because of the initial costs and uncertain payoffs associated with OA. Anecdotal evidence suggests that software costs, training costs, and the time required to become informed about OA appear to be particularly burdensome to small firms (*Business Week*, October 8, 1984: 126,130). These inhibiting factors may be offset by the availability of new, small, multitasking systems designed for small businesses.

Behavioral Factors

Considerable anecdotal material has accumulated that describes a variety of behavioral factors that have limited or even halted the introduction of office automation. Some managers fear or are ignorant of the computer and do not want to reveal their inadequacies; they cannot or do not want to learn to use a keyboard; they do not want to lose the status symbol of a personal secretary. Middle managers fear that many of their functions such as data manipulation and forecasting will be automated. Clerical workers are concerned about "electronic sweatshops" in which a piece-work situation is closely monitored by machines. To our knowledge, little work has been done to document the pervasiveness or intensity of these situations. One exception is an ongoing study of the implementation of OA equipment and procedures in 55 offices representing a range of industries and staffing patterns (Bikson and Gutek, 1983a). The first round of interviews with 530 employees suggested that the amount of resistance to OA among office workers may be less than is often assumed. The researchers found that

> "...problems with implementing computer systems in white collar settings are not technological in nature. Users think the technology itself is fine. What affects how much and how well it is used are organizational, environmental, and training matters that organizations should be able to address." (p. 18)

Key management factors that were important to productive use of the technology were the organization's orientation to change and the variety of tasks included in a single job.

Many anecdotal sources and case studies suggest, on the contrary, that numerous behavioral factors will impede the spread of OA. For example, face-to-face communication, an integral element of job satisfaction, could be threatened by electronic communication made possible by OA. Changes in direct control over employees can be manifested, negatively, at several levels. The geographic decentralization of work means that some managers will have fewer opportunities to observe their employees directly, possibly leaving them frustrated by a sense of lost control. At the other extreme, some clerical workers now can be monitored electronically, their output and error rates recorded and used as the basis for pay and promotion (National Science Foundation, 1983; Gregory and Nussbaum, 1982). Some managers simply fail to appreciate the relatively intangible advantages offered by office automation. In the absence of clear labor savings, managers are reluctant. Some comments from managers will illustrate (from Curley and Pyburn, 1982: 32).

"We feel that we've conquered the secretarial problem, but we're not sure if office automation will really improve managerial productivity or just give them more time to play golf.'

"If I can buy a metal stamping machine that turns out 100 parts per day, I know what I'm getting. If I can increase its output by 10%, I know I'll get 110 parts per day out of it. I can calculate the cost of the machine, figure out the return it will give me, and tell you whether it's a good investment or not. I don't know what buying electronic mail will do for me."

Finally, the power of habit, familiarity, and inertia should not be underestimated. In those service industries where the competitive advantages to be gained from automating are unclear, the pace of change will be slow.

Organizational Factors

If Strassmann (1980) is correct, the productivity gains of office automation will not be fully realized until office work at the most fundamental levels is reorganized. The first "wave" of office automation targeted clerical functions. OA simply replaced mechanical devices such as the typewriter and calculator with their microprocessor-based counterparts. Its implementation required only superficial reorganization of work. While some gains in efficiency have resulted, major gains in office productivity must await the "second wave" of automation, which will involve managers and technical/professional workers. Work flow and jobs will be linked to the introduction of local area networks (LAN) that permit communication among workstations. This restructuring of nonclerical office functions, workflow, and jobs will be costly and will occur over an extended period. Once a firm carries out such a restructuring, the resulting gains in competitive advantage may drive other firms in the industry to follow suit rapidly.

But these changes will occur at widely varying times in different industries over the next several decades. Strassmann estimates that the major changes envisioned will be occurring well into the next century. Moreover, the process by which this restructuring occurs is unlikely to follow the "rational planning" approach in which the productivity gains of OA under different organizational configurations are analyzed in advance of purchasing decisions. In the view of several advisers to this study, restructuring will be evolutionary and reactive in character. Companies will "back into" strategic planning for OA only after it has already become a significant, visible, and costly element of a firm's activities (R. Peabody, G. Bacon, personal communication, 1984).

Macroeconomic Conditions

The overall strength of the economy assuredly will affect the rate of office automation's penetration. In general, high rates of economic growth will mean increased rates of investment in office automation, but it should be noted that very rapid rates of market penetration could produce the threat or actuality of structural unemployment. Reactions to such a threat might include white-collar unions, stronger social pressure on firms to retain surplus workers, increased retraining expenditures, or even a shortened work week. Generating forecasts using different macroeconomic assumptions is one accepted way to deal with the problem. While we do not know the penetration rate at which structural unemployment would occur, we know that the rates that prevailed in the 1960s and the 1970s (see discussion and accompanying figures below) did not produce large-scale unemployment of clerical workers. But it must be remembered that the absolute level of these earlier expenditures was quite small, so that these rates of growth would not have the impact during earlier periods that similar rates at present and in the future would.

Historical Trends in Office Automation Use

The National Income and Product Accounts show that sales of "office and computing machines as producer durables" grew from $3.2 billion in 1967 to nearly $27 billion in 1982, an average annual rate of 16% (Figure 2). Other government sources, the Census Bureau's _Current Industrial Reports_ and _Annual Survey of Manufactures_, show close agreement with these figures. (The Current Industrial Reports defines "office, computing, and accounting machines" to include the following major products: electronic computers and peripheral equipment, parts and attachments for electronic computers and peripheral equipment, automatic typing and word processing machines, accounting machines and cash registers, and typewriters, dictating, transcribing, recording machines.) A second source, the International Data Corporation (_Predicasts Basebook_, 1983), shows expenditures by U.S. computer users for "computers and auxiliary equipment" rising from $6.75 billion in 1972 to $24.3 billion in 1982, an average annual rate of 13.1% (Figure 2).*

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*The Commerce Department data (National Income and Product Accounts, Census Bureau) include sales of mainframe and other computers that should not be considered part of office automation and may overstate the actual levels of OA sales. The close agreement between the Commerce Department and IDC is probably fortuitous, since the product definitions and markets considered probably differ. Unfortunately we have not yet obtained a copy of the IDC report cited by Predicasts.

Interestingly, the same source shows expenditures for "staff-related expenditures" by computer users also increasing at about 13% annually but totalling substantially more than the hardware expenditures in every year (Figure 2). For comparison, over the period 1967 to 1980, total nonfarm business expenditures for equipment of all types rose from $51.2 billion to $178.1 billion, an average annual increase of 10.1%. Thus, in 1980 U.S. expenditures for "office and computing machines" represented roughly 12% of total expenditures for equipment. (Economic Report of the President, 1984).

Between 1963 and 1980, the wholesale and retail trade industry increased its annual investment in "office, computing, and accounting machines" from $189 million to more than $1.5 billion. Over the same period, investment by the finance, insurance, and real estate industry rose from $318 million to more than $5.5 billion (Table 1). These represent annual rates of growth of 8.1% and 11.2%, respectively, both larger than the 7.3% annual growth rate exhibited by manufacturers in all equipment over the same period (Table 1).

Capital Constraints and the Market Penetration of Office Automation Equipment

Firms will expend capital to automate their office functions in two major categories: equipment (including software) and implementation. Implementation costs include the costs of training employees to use the new equipment, the costs of reorganizing work to realize the full benefits of OA beyond its impact on clerical functions, and some of the costs of retraining workers displaced by the new technology. A firm's decision to automate its offices does not, of course, lead to a single, lump equipment purchase. Capital expenditures, maintenance costs, and support costs (e.g., training, software updating) will be ongoing. From a budgetary perspective, office automation involves deciding what percentage of the budget will be devoted to OA over an extended period. As we noted earlier, implementation costs may equal the costs of hardware, and continuing support costs may be equally large. However, we found only casual estimates of the relative magnitude of these costs.

Our approach in this section is to develop historical data on equipment expenditures by industry to gain some insight into the factors that may have influenced expenditures for equipment generally and expenditures for office automation equipment specifically. Our purposes are twofold: first, to examine the extent to which patterns in industry expenditures for equipment can be accounted for by factors such as the availability and cost of capital. Second, we present trend data on indicators such as investment in equipment as a proportion of industry product that, if extrapolated, could be used to identify forecasts of OA penetration that fall outside the bounds of past investment behavior.

Figure 3 (data in Table 2) shows trends in the value of net equipment stock (in current dollars) per employee in manufacturing, finance, and trade industries over the period 1950-80. Clearly, the finance industry is now accumulating net stock per employee at a much higher rate than the average for all manufacturing industries or for wholesale and retail trade. These figures indicate that the 1980 net value of capital stock per employee in the finance industry was more than $17,000, in contrast to an average of $12,000 per employee across all manufacturing industries. If, however, we consider that only 40-60% of manufacturing employees are engaged in production (in 1978 42% of manufacturing employees were operatives and 20% were craft and kindred workers), the value of capital stock per production worker in manufacturing in 1980 was between, roughly, $20,000 and $30,000. Virtually all employees in the finance industry are "production workers" (92% are managers, professionals, sales, or clerical workers), so the equivalent figure for finance is about $19,000 per "production" employee. Of course, equipment consists of far more than production equipment: it includes, for example, vehicles, furniture, and instruments. According to Commerce Department data, in 1980 40% of the finance industry's investment in new equipment was spent on "office, computing, and accounting machinery." This proportion has remained around 30-35% since 1960 (see Table 1). On the other hand, a larger proportion of many manufacturing industries' investment in equipment is spent for "production" equipment. For example, in 1980 the motor vehicle industry spent nearly 90% of its total expenditures for equipment on production machinery, but only 1% for office, computing, and accounting machines (calculated from U.S. Department of Commerce data).

Analysts of trends in office automation often refer to the relative undercapitalization of office-dominated industries relative to manufacturing (ratios of 5 to 1 or even 20 to 1 are seen), but if these data are valid indicators of capital per worker, then the gap is smaller than many suppose, at least in the finance industry, and is closing rapidly.

Industry's past rates of investment in new equipment offer another possible indicator of future constraints on the market penetration of OA equipment. Trends in investment also offer an opportunity to test whether short-term fluctuations in the cost or availability of capital have similarly short-term effects on the investment rate. Table 3 shows trends in annual investment in new equipment, in manufacturing, wholesale and retail trade, and finance, as a proportion of each industry's gross domestic product. During the decade 1970-1980, manufacturing investment in new equipment (current dollars) rose at an average annual rate of 13.1%; in wholesale and retail trade it rose at 9.9%, and in finance at 10.8%. There is no particular reason to expect that the ratio of annual investment in new equipment to gross domestic product should be similar across indstries, although it is reasonable to expect that office-dominated industries such as finance will approach the level of investment exhibited by manufacturing--perhaps before 2000, if present rates of investment in the service industries increase slightly.

Figure 4 illustrates the data of Table 3. If one assumes (not unreasonably, based on current trends) that investment in new equipment by the finance industry will reach 8% of industry GDP by 1990 and 10% by 1995 (constant dollars), this affords one basis for identifying unrealistic market penetration forecasts. Personick (1983) reports BLS projections of gross product for the finance industry in 1990 of $325.4-351.5 billion in 1972 dollars (depending upon the economic scenario chosen) and in 1995 of $384.6-405.5 billion. If about 40% of the 10% of GDP equipment expenditures are for office, computing, and accounting machinery, annual office technology expenditures by the finance industry alone could easily reach $10 billion by 1990 and $16 billion by 1995 in 1972 dollars. Assuming a 5% inflation rate, this yields sales estimates of around $24 billion in 1990 and $50 billion by 1995. (Note that the finance industry spent $5.5 billion in 1980 on office, computing, and accounting machinery.)

Figure 5 shows that annual capital expenditures for equipment per worker, led by the transportation and utilities industry, vary widely among nonmanufacturing industries. Although the transportation industry led in the amount of expenditures per worker (over $7500 newly invested per worker in 1980, in current dollars), the finance industry exhibited the greatest growth rate between 1960 and 1980 (12.6% annually). The sharp increase in rate of investment in equipment beginning in the mid 1960s undoubtedly reflects in part the computerization of "back office" clerical functions in the finance industry that began during this period.

A comparison of Figure 5 with Figure 6, trends in the prime interest rate charged by banks, suggests that the rapidly increasing investments in equipment occurring in the transportation and finance industries were only slightly, and temporarily, influenced by sharp increases in the cost of capital in the late 1960s and during 1972-75. While our data end in 1980, the effects of the beginning recession are seen in the falloff in investment in 1980. Corporate profits in several nonmanufacturing industries (Figure 7) appear to have had little effect on the rate at which industry invested in capital equipment per employee. According to these data, at least, short-term variations in the cost and availability of capital seem to have had few immediate effects on the rate of industry investment in equipment. This, of course, suggest nothing about the effect that longer term trends in interest and profit rates, or their average absolute levels, have on long-term trends in investment. For this one must consult econometric models of the economy, a task beyond the scope of this paper.

Training for, and Implementation of, OA Equipment

The American Society for Training and Development estimates that industry spends $40 billion annually on education and training for employees (U.S. Congress, OTA, 1983:33). Approximately 11 million workers are receiving job-related training; two-thirds of these participate in in-house programs, while the remainder are enrolled in programs provided by colleges and universities, vocational schools, unions, government agencies, and community-based organizations (U.S. Department of Labor, BLS, Bulletin 2206, 1984). Despite these impressive numbers, there is a general consensus that job-related training is a rarity among U.S. workers. The Commerce Department estimates that, through 1978, about 6% of all employees between the ages of 25 and 49 received job-related training from their employers (Bikson and Gutek, 1983b).

Many employers are relying upon vendor-provided training during this early period of penetration of OA equipment. Vendors provide training for their dealers, and some offer seminars and classes at their local offices or at dealer offices. As vendors seek to shift training costs to purchasers of their equipment, self-paced training packages (cassettes, manuals, exercise workbooks) are becoming more popular (Friedman, 1982).

But evidence is growing that this approach will not suffice, particularly as the focus of training programs moves from clerical workers to managers and other professionals.

A survey by Training/HRD magazine found that, even when training was supplied to workers, it tended to emphasize short-term objectives and failed to reflect planning or systematic program development on the part of managers (cited in Bikson and Gutek,1983b). Preliminary results of the Rand Corporation's study of OA implementation in 55 work groups (Bikson and Gutek, 1983a) offer some basis for judging the future of employer-based training for OA. Bikson and Gutek found that, despite the fact that offices participating in the Rand study are early adopters of OA equipment, low priority is given to employee training. Because a number of training variables were found to influence the successful implementation of OA equipment in the offices studied, Bikson and Gutek concluded that:

o vendors who supply flexible, comprehensive training rather than training for only initial use of their products or self-instruction programs will have a competitive advantage.

o changes will occur in current training practices as higher-paid workers require training.

o as organizations recognize that technological change occurs rapidly, necessitating continual training, they will be more willing to invest in longer-term programs.

As we noted earlier, casual estimates of the cost of implementing OA tend to approximate the cost of OA hardware. Using the data of Figure 2, this means that employers spent on the order of $20 billion for employee training in 1982. If this pattern continues, and vendors successfully transfer the bulk of training costs to end users (as seems likely), then training costs could have a significant retarding effect on the rate of penetration of OA equipment. But whether this actually occurs will depend on many factors, including whether training costs are included in a firm's initial decision to purchase OA equipment, the software's degree of sophistication (i.e., its "friendliness"), and whether cost savings rather than competitive pressures based on quality of service are the driving force behind the decision.

The availability of persons in the labor force with requisite skills may, in some regional labor markets, prove significant for the spread of office automation. On the one hand, demographics alone may stimulate some companies to automate. The combination of labor migration patterns and a declining rate of new entrants into the labor force following the "baby boom" may leave certain local labor markets (e.g., the midwest and New England) with a shortage of labor at all skill levels. Large firms, unable to relocate but facing a tight local labor market, may choose OA as the only way to expand business output (R. Peabody, personal communication, 1984). There may be an opposing force, however, that may not become manifest until well into the 1990s and beyond: the inadequacy of secondary and high school education for the "computer age." The issue goes well beyond computer literacy to the concern, expressed in recent reports on the state of American education, that fundamental skills such as communication, analysis, and "common sense" will become crucial if computers are to be used effectively. Future OA systems will be very user friendly, will possess enormous computational power, and will provide volumes of data on command. The central issues for users will involve knowing what questions to ask, what the data mean, and when the output simply doesn't make sense. Teaching persons these fundamental skills is not easy, yet locating workers who possess them will be increasingly important for office managers. Short, remedial training courses are unlikely to suffice.

Forecasts of the Penetration of Office Automation Equipment

Forecasts of OA market penetration take two major forms: (1) the dollar value of manufacturer shipments and/or sales of particular products, and (2) the number of units of products shipped or in place (installed base) in a given year. Each is useful for different purposes, and different data can be brought to bear to assess the credibility of forecasts or to help set the context for additional forecasts. In particular, sales forecasts obviously are useful for estimating the implications of OA for the national economy, for vendor/dealer revenues, and for end user expenditures. For these forecasts, our trend data and extrapolations of annual expenditures by industry for new equipment offer one means of bounding estimates of future expenditures by users for OA equipment. Forecasts of unit penetration, especially installed base, can be compared with the number of likely users to gain some idea of current and projected market penetration as a proportion of the total eventual market. In the following sections we pursue both approaches; we begin with forecasts of the installed base of OA equipment.

Installed base. One difficulty with interpreting most market penetration forecasts is that it is very difficult to specify in advance what the size of the eventual market will be. (In the 1950s IBM thought they would sell only a few mainframe computers, primarily to government.) Thus, during the initial stages of the diffusion of an innovation, it is difficult to specify what level of penetration (as a proportion of the total potential market) has been achieved, or what level of penetration a particular forecast (measured in sales or number of units) represents. In the case of office automation technology, however, we do know how many of what types of office (white collar) workers are in the labor force. The Bureau of Labor Statistics (BLS) prepares projections of employment by major occupational category (managers, clerical workers, etc.). A 1975 evaluation of the occupational projections BLS made in 1967 found that the difference between projected and actual employment for major occupational groups ranged from a 6.7% underestimate for clerical workers to a 9.1% overestimate for operatives. The projections for more detailed occupations were subject to much larger error, averaging more than 20% (U.S. Department of Labor, 1982: 7). Table 4 shows 1982 levels and projections for 1990 and 1995 for the four categories of white collar workers. There is reason to believe that these projections, especially for clerical workers, may underestimate the effects of automation in reducing employment levels (Roessner, et al., 1984; Drennan, 1983; Leontieff and Duchin, 1984).

The IDC states that by the end of 1983 there were about 18.5 million electronic keyboard devices (PC's other computers, terminals, and word processors) in use, or about one for every three of the 55 million white collar workers. By 1987, they forecast 54 million electronic keyboard devices, or virtually one for every white collar worker (IDC, 1983:94)*. They further forecast an installed base of about 19 million PC's in the U.S. business/professional market by 1987, or about two PC's for every three managers and professional workers, assuming these occupations are the first to enjoy the benefits of the PC (*EDP Industry Report*, July 8, 1983: 2). At this rate of market penetration, it is clear that by 1990 virtually all white collar workers in the United States will be working with electronic keyboards, and that most, if not all, nonclerical white-collar employees will be working regularly with a PC or electronic workstation (see Fig. 8). By 1995, every manager, professional/technical worker, and office salesperson should be working with an electronic workstation. (This represents an installed base of between 30-40 million PC/workstations.) By 1990, in other words, analyses of the impact of office automation on office work and workers will shift from consideration of the shock of, and resistance to, initial exposure to OA equipment, to how, and how rapidly, office work and occupations will be restructured to take advantage of the continuously-improving office technologies that will be available in the marketplace.

Stated differently, future OA sales will be a function of the replacement rates for in-place, automated equipment rather than of the rate of acceptance of OA equipment among the uninitiated. If the IDC forecasts are prescient, this transition will occur about 1990 for OA equipment intended to perform or complement clerical functions, and will occur about 1995 for OA equipment intended to perform or complement managerial and professional/technical functions.

Sales forecasts. Most OA sales forecasts, many of which appear in the trade literature, that are supported by analytical work actually are based on a very small number of sources. Firms such as Predicasts, Inc., International Data Corporation, and International Resource Development, Inc., develop and sell market

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*Much of the available forecast data are generated by vendors or consultants who sell information to vendors. This *may* introduce a bias in forecasts toward more rapid penetration.

analyses and forecasts. While the number of different OA forecasts is small, their accessibility is problematic because of their high cost. We have had to rely (as of this writing) on summaries of larger studies appearing as advertisements (IDC, 1983) or on references to these studies that appear in other publications (IRD, 1983; Predicasts). In this section we describe the available forecasts and, where possible, attempt to explain the wide variations among them by differences in the types of equipment included in the forecast.

Fig. 9 depicts the forecasts of three major sources: Predicasts, IDC, and *Electronics* magazine. The Predicasts study, *The Office of the Future*, shows sales of "automated office equipment" (SIC 3570) growing from $15.3 billion in 1980 to $37.6 billion in 1995. *Appliance* magazine, citing the same study, states that sales of OA equipment will grow from $6 billion in 1980 to $18.8 billion in 1995. According to *Appliance*, the latter definition of OA includes text generation equipment, text reproduction equipment, electronic mail terminals, and teleconferencing and executive workstations. The more inclusive definition of OA used in the same study probably includes sales of PC's, networks, and PBX equipment. A comparison of Fig. 9 with Fig. 2, past sales of "office, computing, and accounting machines," shows a discrepancy of some $10 billion in 1982 sales, largely attributable to the inclusion of mainframe and minicomputer sales in the Commerce Department's data.

The two shorter-term forecasts, by International Data Corporation (IDC) and *Electronics* magazine, depend substantially upon the types of equipment included. IDC defines office automation as:

- personal computers for office and industry
- word processors and electronic typewriters
- private branch exchanges (PBX)
- copiers
- multifunction computer systems and local area networks (LAN).

Electronics magazine's definition is limited to:

- copying equipment
- dictation equipment
- electronic typewriters
- local networks
- word-processing systems.

The two definitions yield 1987 forecasts that differ by a factor of two. If the magazine's "small-business personal computer systems" sales forecasts are added to the office automation results, the IDC and *Electronics* forecasts are comparable in both definition and result (Figure 9). If sales forecasts of small-business, professional computers are also included the *Electronics* forecast would yield 1987 domestic sales of $58 billion.

One way to deal with such wide discrepancies is to seek sales forecasts for individual types of OA equipment such as PC's and word processors. Unfortunately, this effort yields only slightly more useful results, as Fig. 10 suggests. The 1987 sales forecasts for word processors and electronic typewriters by IDC and *Electronics* are close: $5.7 billion and $6.7 billion, respectively. They also agree closely with Predicasts' forecast of "word processing equipment" sales, which matches the IDC figure in 1987 and extends to a 1995 estimate of nearly $8 billion. But forecasts for PC sales by 1987 vary widely, with IDC forecasting U.S. shipments for business and professional use at $13.6 billion and *Electronics* forecasting sales of "small business computer systems, less than $5,000" at $25 billion. The differences may be due to the inclusion of system costs in the *Electronics* forecast. Forecasts of sales for executive workstations are so varied as to be virtually useless for presentation here. The reason for their noncomparability rests largely in the lack of consensus on a definition for the workstation. Some refer to standalone units, others to "multifunction" workstations used by as many as several dozen persons, "multi-feature" workstations, etc. Another reason forecasts of market penetration by type of OA equipment are so difficult--and variable--is that OA product categories quickly become obsolete. For example, stand-alone word processing is already being replaced with multiple-use equipment, PC's will become system workstations, and PBX's will integrate with workstations and voice/data terminals (R. Pilc, personal communication, 1984).

In 1987 there will be about 58 million white collar workers in the U.S. If OA equipment sales were to reach $58 billion in that year, as the *Electronics* forecast shown in Figure 9 suggests, an *additional* $1000 of new OA equipment per white collar employee would be added in that year alone. Fig. 3 shows that during 1975-1980 the finance industry increased its net capital stock per employee by an average of about $1,700 annually, of which about 40%, or $700 per employee, consisted of office, computing, and accounting equipment. This rough calculation suggests that, in order to reach the annual investment rate implied by the *Electronics* 1987 forecast, all office-dominated industries in 1987 would have to invest, on average, at a rate greater than that exhibited by the finance industry in 1980. While this may not seem likely, recall that the rough calculations made earlier, based on extrapolation of the finance industry's rate of investment in OA equipment as a proportion of the industry's gross domestic product, implied OA sales of $24 billion in 1990 and $50 billion *for that industry alone*. On this basis, the IDC forecasts, extrapolated to 1990, are not out of line. Whether OA sales of the magnitude suggested by the *Electronics* forecasts could be attained ($65 billion+) will depend upon the rapidity with which other heavily white-collar industries (e.g., trade, business services, and government) follow the lead of the finance industry.

Summary

The very high proportion of office costs expended for salaries and wages will continue to drive the penetration of office automation equipment in industrial markets in the near term. But the significance of labor savings will decline in importance as the focus of OA shifts from clerical to managerial functions in the bellwether industries, and as OA begins to penetrate those industries in which office work does not play a dominant economic role. Competitive forces in some service industries, those based on the variety and quality of services offered, will provide an additional stimulus.
These forces will be offset to some extent by the shortage and high cost of skilled labor to operate the new machines and train others to use them. As the second wave of automation gains momentum toward the end of the century, the need to restructure work in fundamental ways may raise considerably the cost of moving to the next stage of automation that involves all levels of the office work force. In the meanwhile, managers' fear and inertia will present significant, but relatively short-term, constraints on the rapid spread of OA equipment.

Several factors we mentioned will have little effect on the pace and pattern of market penetration, at least in our view. There is little doubt that cost-effective (measured in traditional fashion) hardware that promises major productivity gains will be available in the marketplace. The cost and performance features of this hardware will not prove to be either major stimuli or barriers. Estimates of savings in labor costs, and traditional comparisons of labor costs against the cost of capital equipment to replace that labor, will not loom large in future decisions to purchase OA equipment.

A tug-of-war between the intangible, difficult to measure benefits of better decisions, higher quality output, and expanded services and the equally difficult to anticipate implementation costs of OA, will be fought in the minds of analysts and managers over the next decades. The analysis of trends and forecasts that follows can do little more than suggest some upper bounds on the pace of market penetration and compare several available forecasts in anticipation of, and as background to, our own.

Office automation based on the microprocessor is a phenomenon of the 1970s. The mainframe and minicomputers that assumed "back office" functions such as inventory control, payroll, and accounting have some claim as the technology that initiated OA, but revolutionary changes in office work and productivity will depend on the market penetration of microprocessor-based equipment in the 1980s and 1990s. By 1980, sales of office automation equipment had reached perhaps $10 billion; this may be no more than 10% of the level of sales that eventually will be reached. In 1980, expenditures by all industries for "office and computing machines" amounted to about 12% of total expenditures for equipment. while in the finance industry (a bellwether for OA) it increased from 29% in 1975 to

41% in 1980. Manufacturing industries exhibit a level of capitalization of about $25-30,000 per production employee, whereas the finance industry exhibits a level of perhaps $8-10,000 of office automation equipment per employee, and the gap is closing.

The cost and availability of capital do not appear to have constrained industry's (short term) rate of investment in OA equipment in the past. Training and implementation costs will assume greater importance as managers and professionals must learn to use the new equipment. These costs may greatly exceed hardware costs and limit the pace of penetration significantly. Very limited evidence suggests that, while managers will have some difficulty justifying the purchase of OA equipment on the basis of cost savings, they will have even greater difficulty justifying the larger, yet essential, costs of implementing and supporting it.

Forecasts of the installed base of OA equipment suggest that, by about 1990, virtually every white collar worker in the U.S. will be working with some kind of microprocessor-based keyboard (or other input technology) device. At this rate of penetration, by 1995 every manager, professional/technical worker, and salesperson will be working with a PC or workstation. This represents an installed base of 30-40 million units.

The most conservative sales forecast places office automation equipment sales at nearly $40 billion by 1995, while others believe that level will be reached in only a few years--well before 1990, depending upon what equipment is included in the definition of OA. These wide discrepancies cannot be fully accounted for until we gain access to the actual forecasts. Overall, these forecasts tend to support our earlier contention that capital costs will not present formidable constraints on the spread of OA equipment. Whether the costs of implementing it, at least equalling the hardware costs, will impose significant constraints is less clear. If they do, then implementation costs plus the behavioral and organizational factors we described may yield sales levels closer to the conservative forecasts for 1995.

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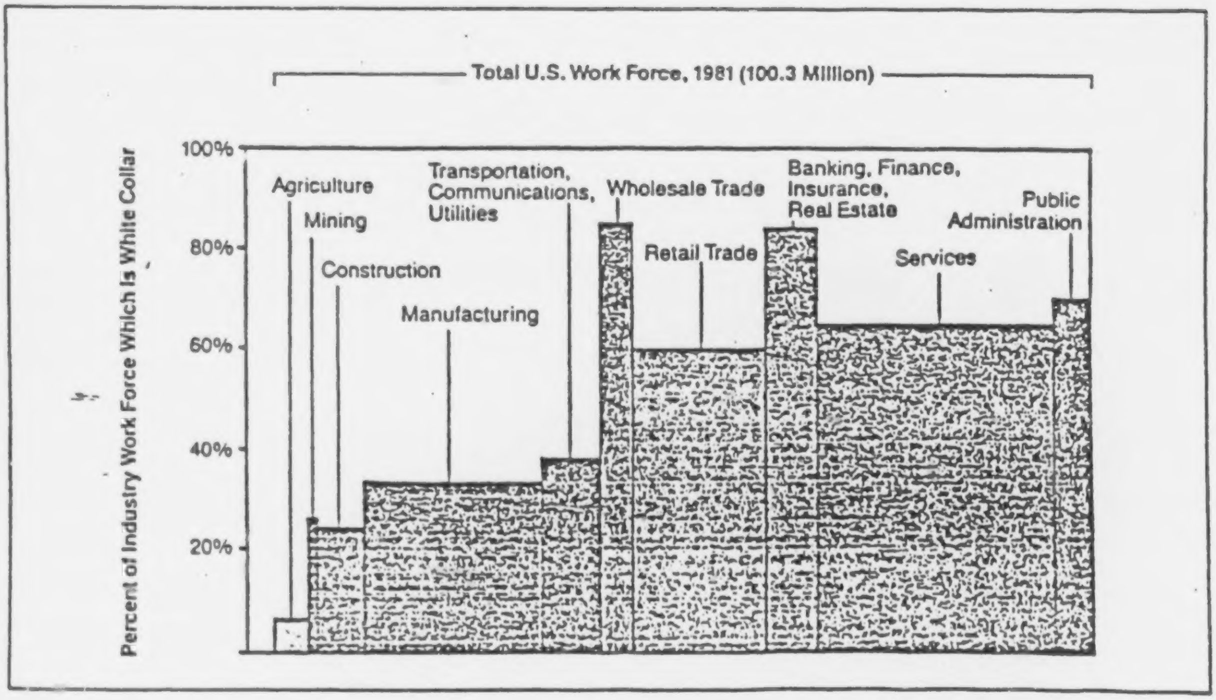
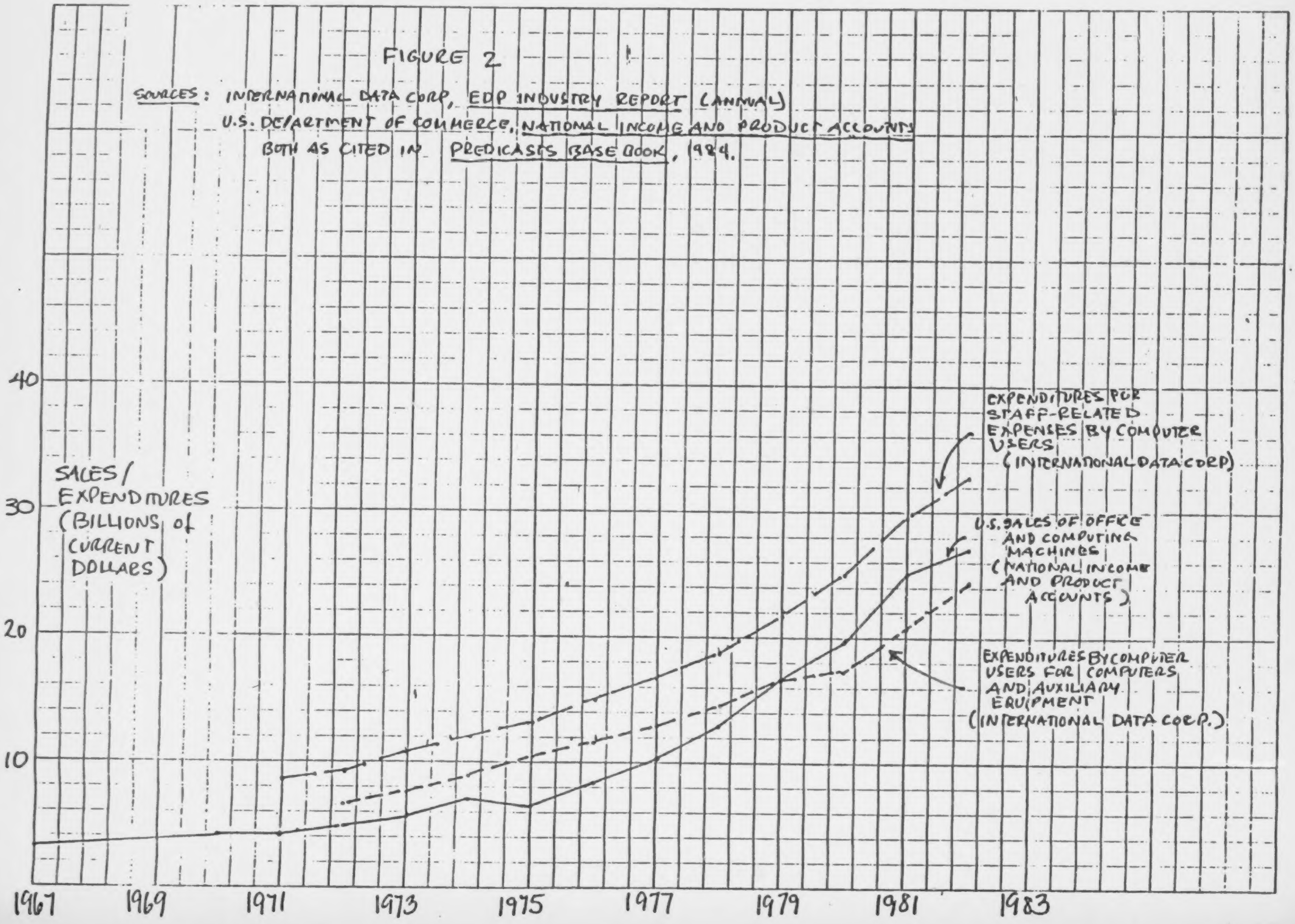
FIGURE 1

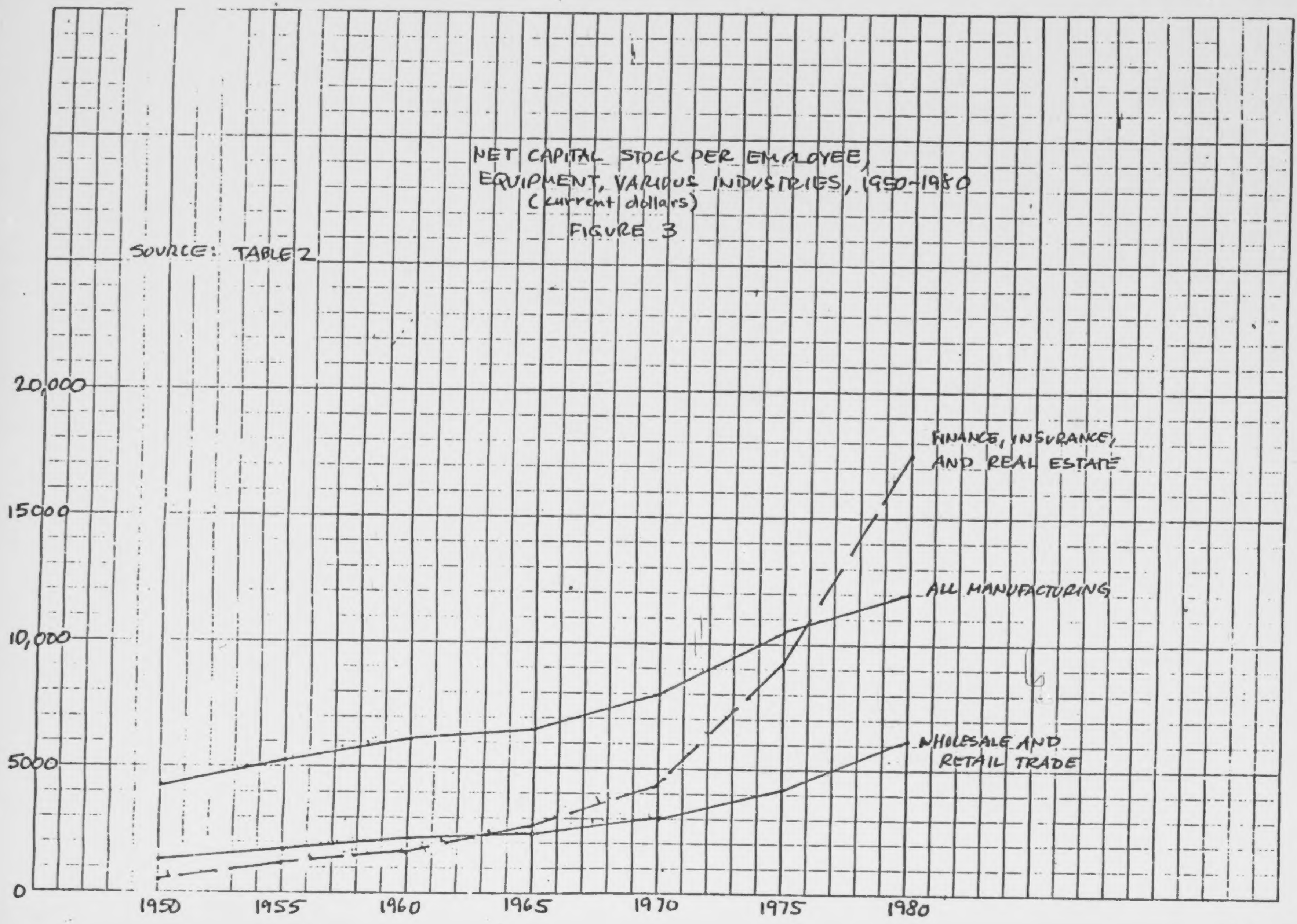


SOURCE: INTERNATIONAL DATA CORPORATION, INDUSTRY WEEK, FEB. 20, 1984: 56

FIGURE 2

SOURCES: INTERNATIONAL DATA CORP, EDP INDUSTRY REPORT (ANNUAL)
U.S. DEPARTMENT OF COMMERCE, NATIONAL INCOME AND PRODUCT ACCOUNTS
BOTH AS CITED IN PREDICASTS BASE BOOK, 1984.





NET CAPITAL STOCK PER EMPLOYEE, EQUIPMENT, VARIOUS INDUSTRIES, 1950-1980
(current dollars)

FIGURE 3

SOURCE: TABLE 2

FIGURE 4

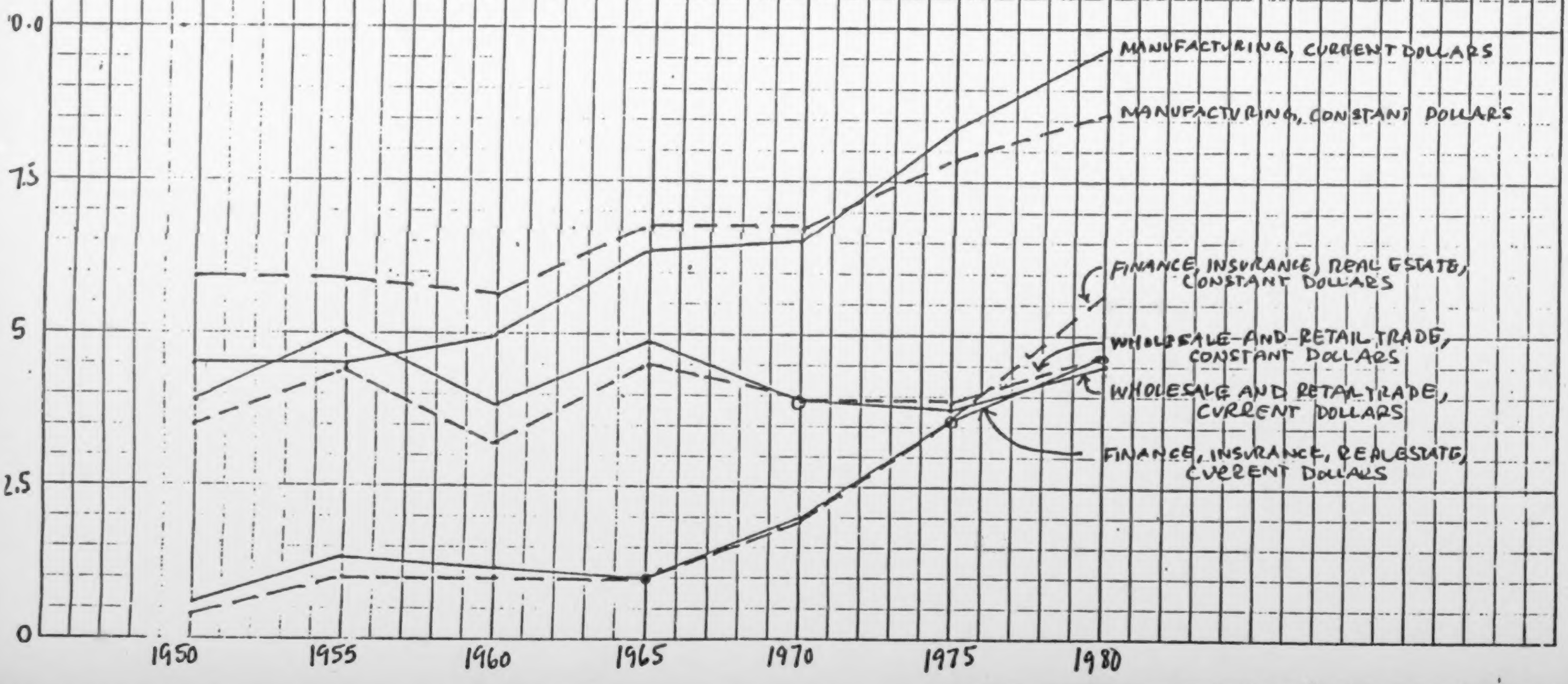
ANNUAL INVESTMENT IN EQUIPMENT
AS A PROPORTION OF INDUSTRY GROSS
DOMESTIC PRODUCT, CURRENT AND
CONSTANT DOLLARS, 1950-1980

SOURCES:

U.S. DEPARTMENT OF COMMERCE, OFFICE OF BUSINESS ANALYSIS, OFFICE OF RESEARCH, ANALYSIS, AND STATISTICS

~~[illegible]~~ ECONOMIC REPORT OF THE PRESIDENT, 1984

(TABLE 3)



INVESTMENT IN EQUIPMENT PER WORKER VARIOUS INDUSTRIES 47-80
(DOLLARS)

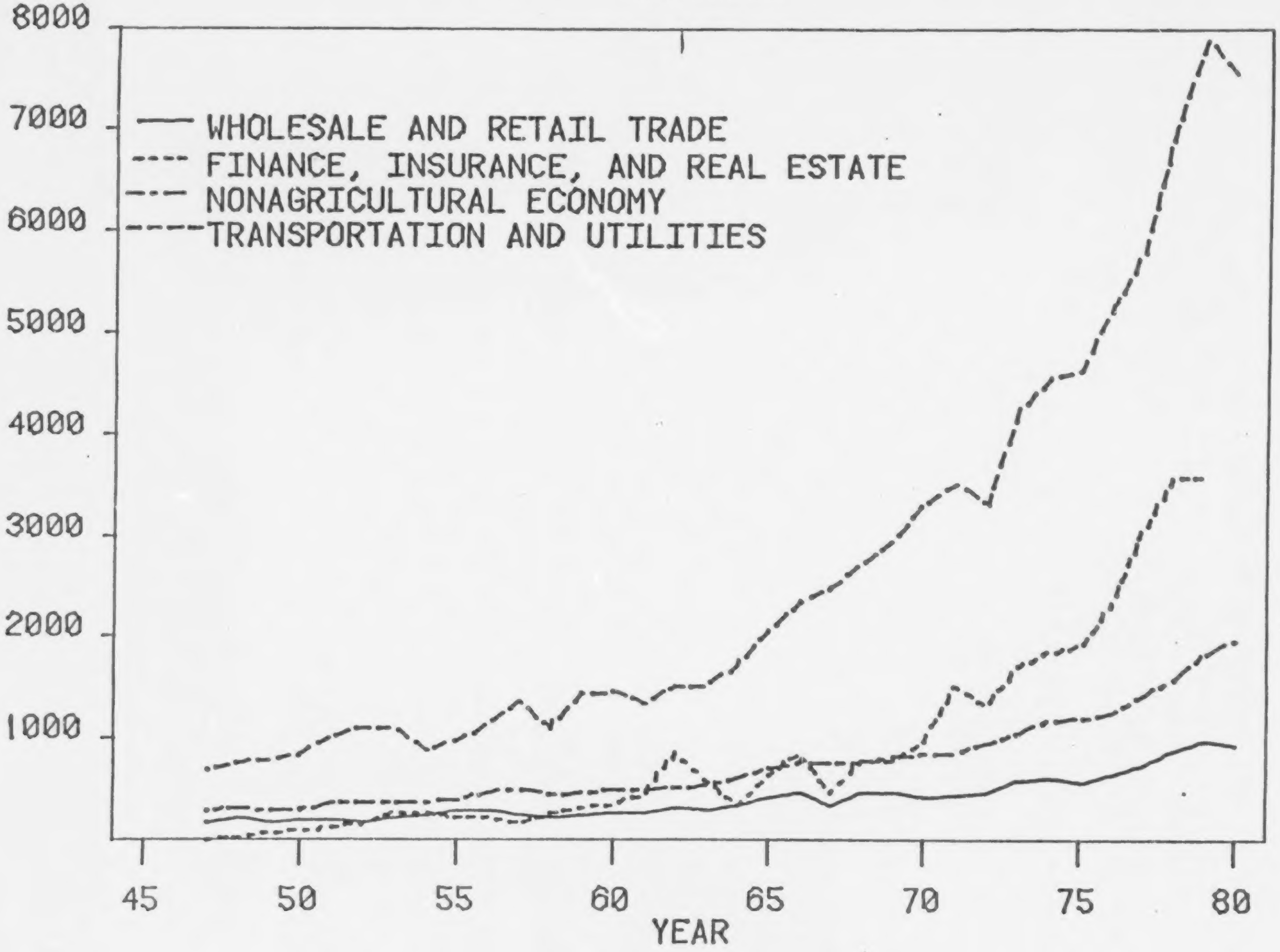


FIGURE 4.5

SOURCES: U.S. DEPARTMENT OF COMMERCE, OFFICE OF BUSINESS ANALYSIS
EMLOYMENT AND TRAINIG REPORT OF THE PRESIDENT

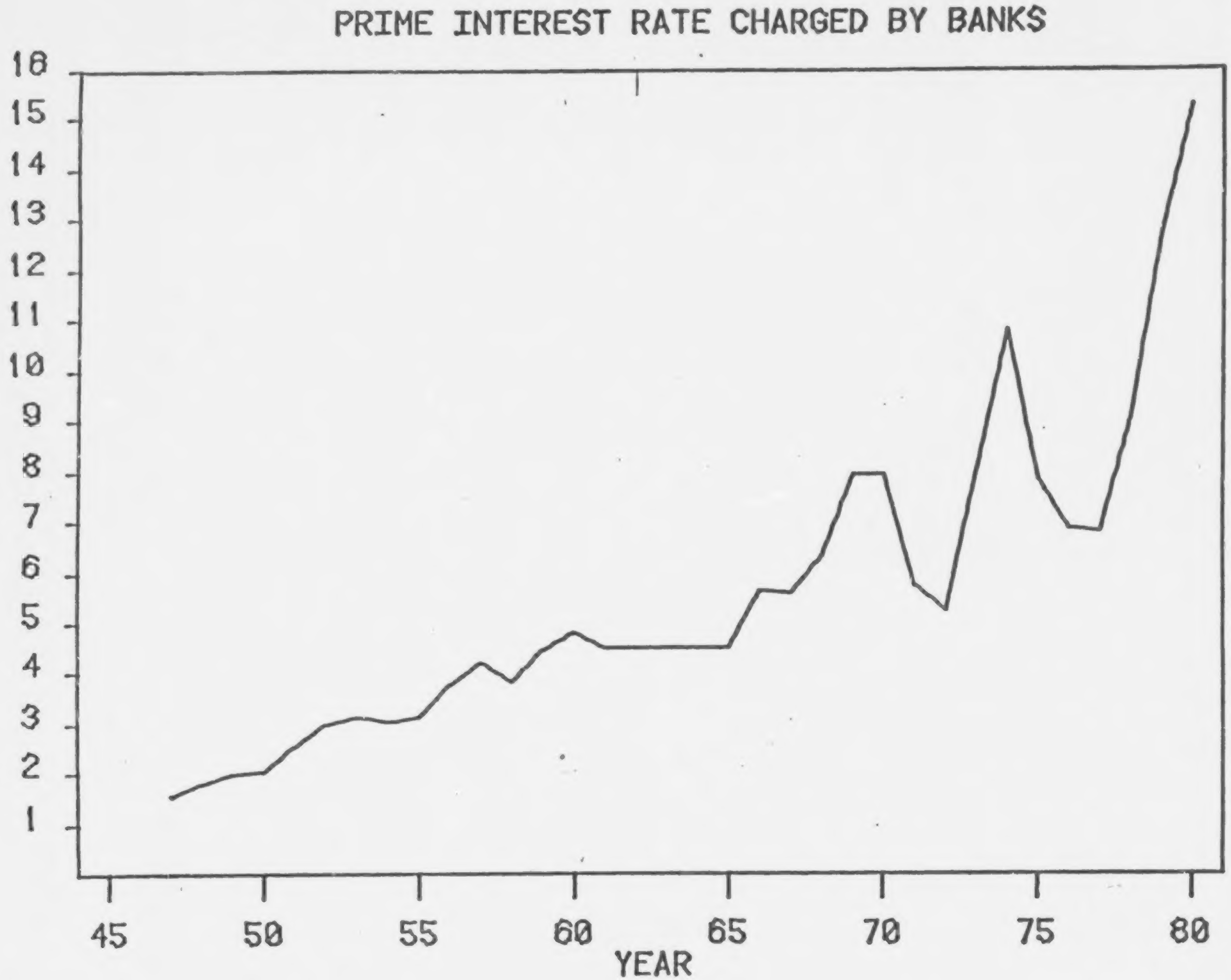


FIGURE 6

SOURCE: ECONOMIC REPORT OF THE
PRESIDENT, 1984

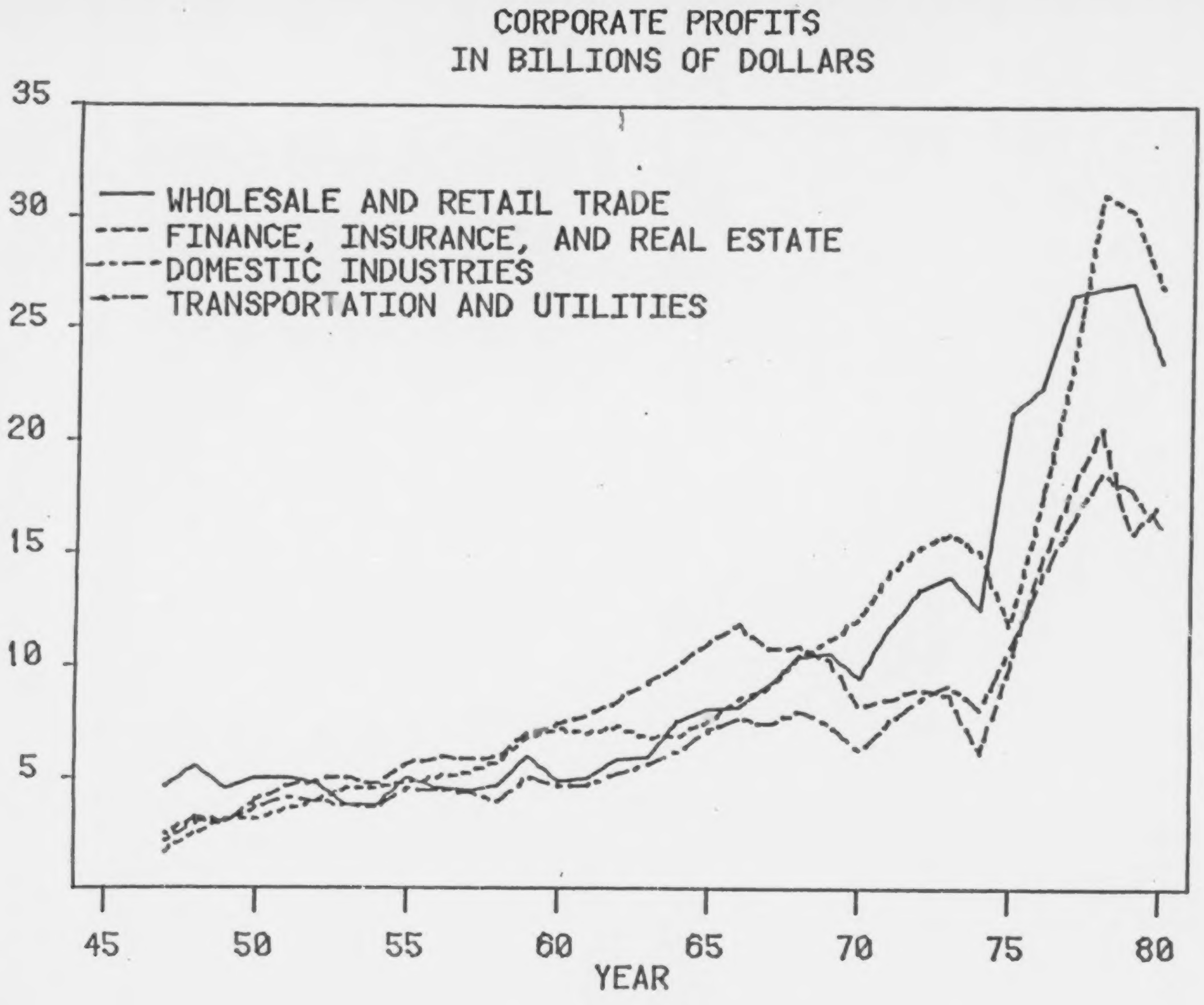


FIGURE 67

SOURCE: ECONOMIC REPORT OF THE
PRESIDENT, 1984

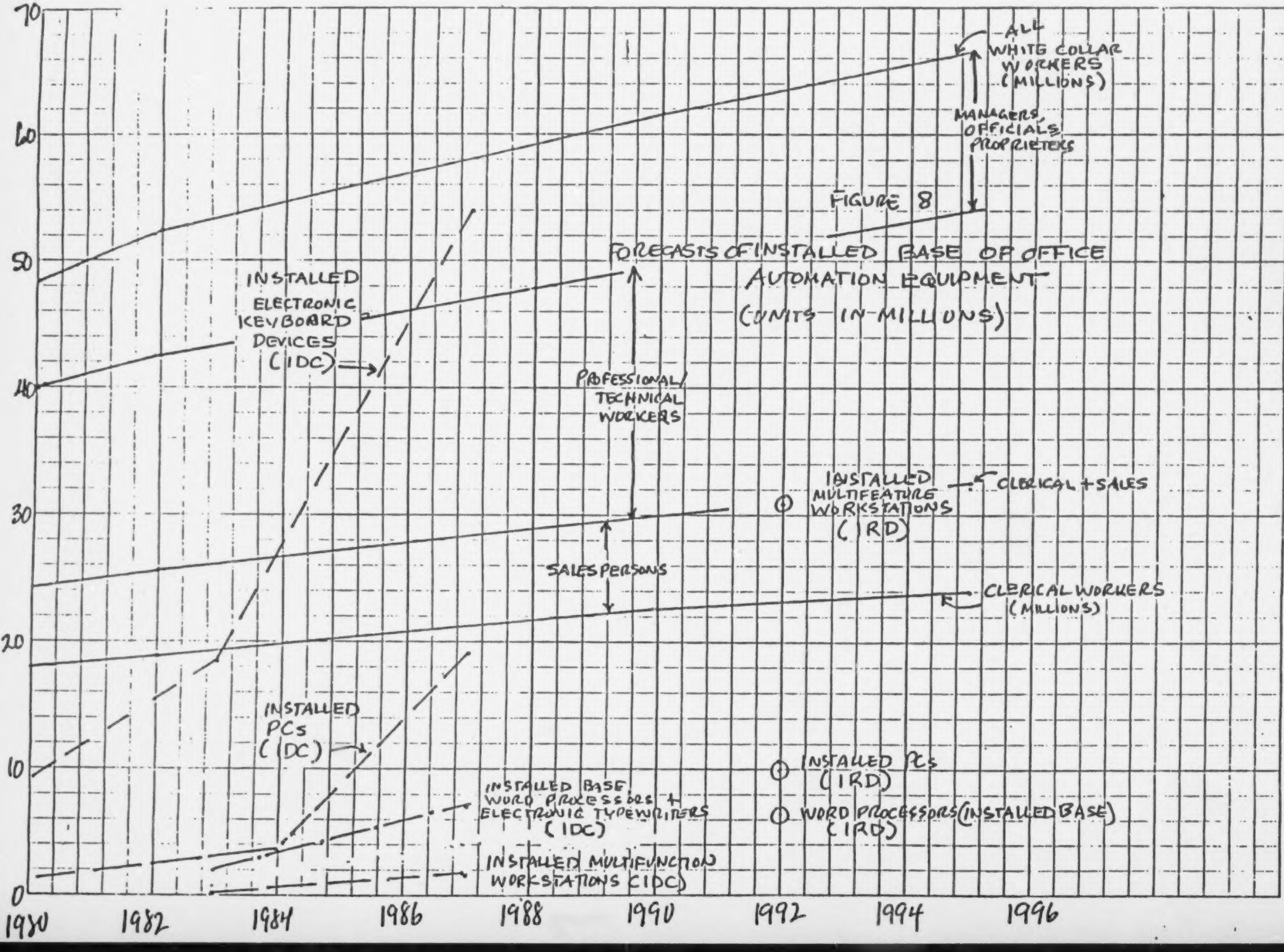


FIGURE 8

FORECASTS OF INSTALLED BASE OF OFFICE AUTOMATION EQUIPMENT (UNITS IN MILLIONS)

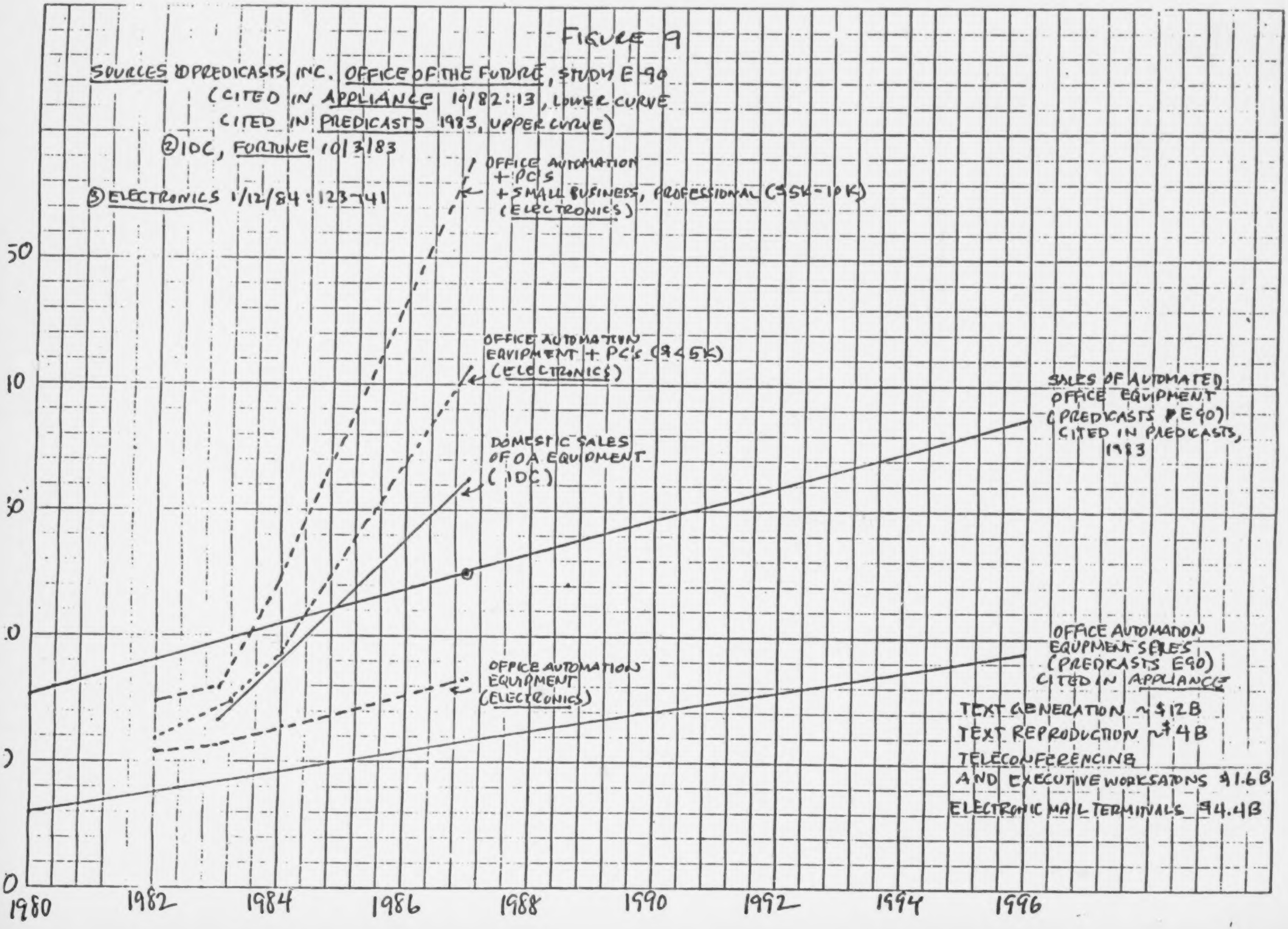


FIGURE 9

SOURCES ① PREDICASTS, INC. OFFICE OF THE FUTURE, STUDY E-90
(CITED IN APPLIANCE 10/82:13, LOWER CURVE
CITED IN PREDICASTS 1983, UPPER CURVE)
② IDC, FORTUNE 10/3/83
③ ELECTRONICS 1/12/84: 123-141

TEXT GENERATION ~$12B
TEXT REPRODUCTION ~$4B
TELECONFERENCING
AND EXECUTIVE WORKSATONS $1.6B
ELECTRONIC MAIL TERMINALS $4.4B

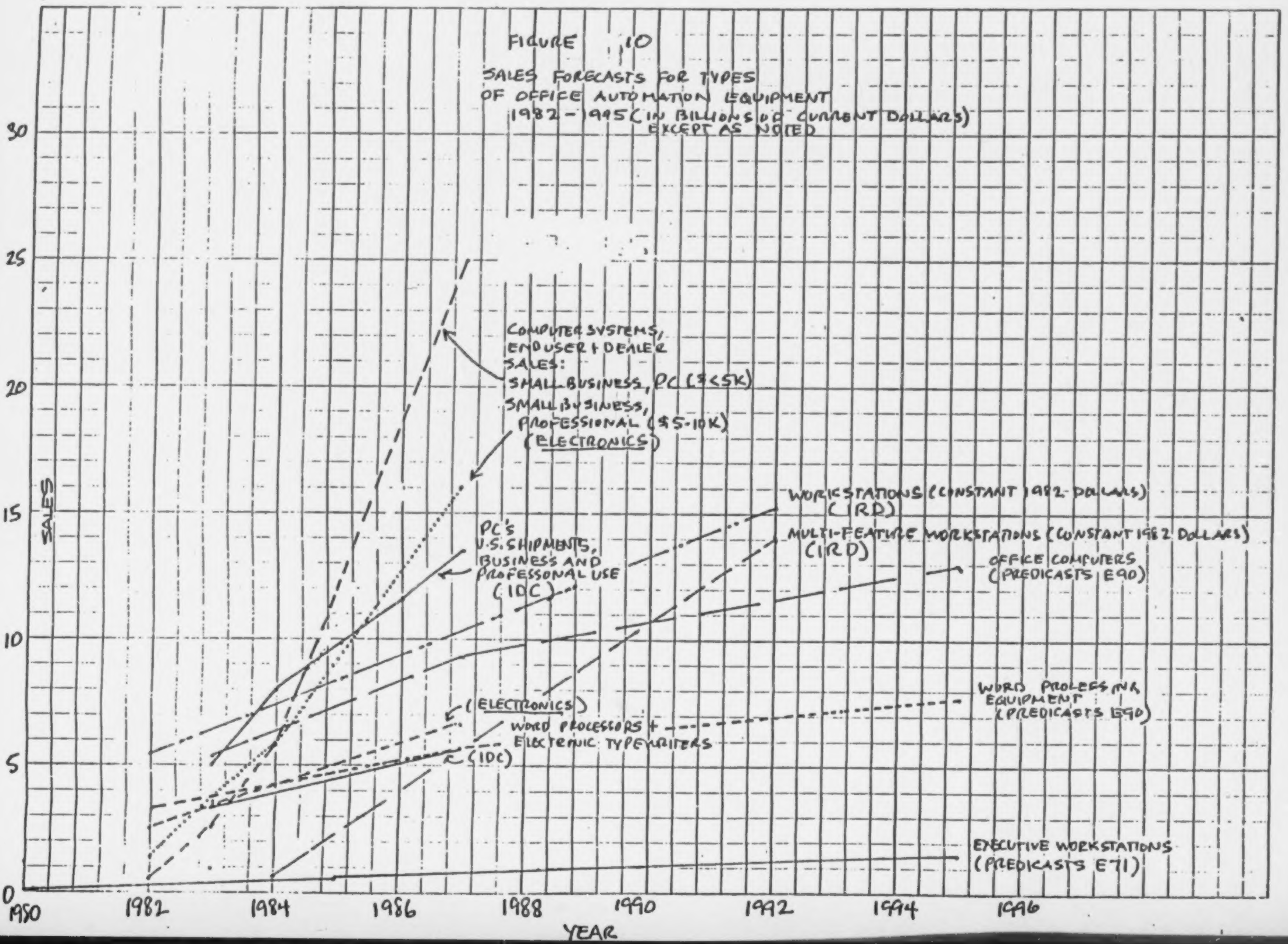


FIGURE 10

SALES FORECASTS FOR TYPES OF OFFICE AUTOMATION EQUIPMENT 1982 - 1995 (IN BILLIONS OF CURRENT DOLLARS) EXCEPT AS NOTED

NATIONAL
42-384

ALL EQUIPMENT AND IN
INVESTMENT IN OFFICE, COMPUTING, AND ACCOUNTING EQUIPMENT, VARIOUS INDUSTRIES, 1963–1980

TABLE 1

	1	2	3	4	5	6	7	8	9	10.
1950	3.8	4.5%	36 N.A.							
1955	5.8	4.5%	N.A.							
1960	7.2	5.0%	N.A.							
1963	8.4	5.0%	3670.8	188.8	0.2%	5.1%	1523.7	318.3	0.4%	35.8
1965	12.5	6.3%	N.A.							
1967	15.7	7.1%	4918.4	291.7	0.2%	5.9%	2779.1	652.4	0.6%	36.2
1970	16.4	6.5%	N.A.							
1972	18.7	6.4%	7692.6	332.6	0.2%	4.2%	5969.3 ~~7767.2~~	1212.9	0.7%	-27.3
1975	29.8	8.3%	9817.0	522.2	0.2%	5.3%	7162.2 ~~8711.3~~	1587.9	0.7%	29.4
1976	32.7	8.0%	11636.9	651.7	0.3%	5.6%	8171.3 ~~10400.6~~	1839.6	0.8%	32.1
1977	40.0	8.6%	13940.0	743.2	0.3%	5.3%	18400.6	2545.1	0.9%	33.4
1978	44.7	8.6%	17377.4	920.4	0.3%	5.3%	14443.6	3484.7	1.1%	33.4
1979	50.0	8.9%	19843.8	1197.6	0.3%	6.0%	17714.6	4655.4	1.3%	36.5
1980	56.4	9.7%	19396.3	1540.1	0.4%	7.9%	18545.0	5541.1	1.4%	41.2
annual growth	7.2% 1963–1980			8.1% 1963–1980				11.2% 1963–1980		

1. Gross investment in equipment, all manufacturing, current dollars, in billions.
2. Gross investment in equipment as proportion of manufacturing gross domestic product.
3. Gross investment in equipment, wholesale and retail trade, in millions of current dollars.
4. Gross investment in office, computing, and accounting machinery, wholesale and retail trade, in millions of current dollars
5. Gross investment in office, computing, and accounting machinery, ~~as a~~ wholesale and retail trade, as a proportion of industry GDP.
~~6. Gross investment in equipment, finance, insurance, and real estate, in~~
6. Gross investment in office, computing, and accounting machinery, ~~wholesale~~ as a proportion of total investment in equipment, wholesale and retail trade
7. Gross investment in equipment, finance, insurance, real estate, in millions of current dollars.
8. Gross investment in office, computing, and accounting equipment, finance; in millions of dollars.
9. Gross investment in office, computing, and accounting equipment, as a proportion of industry GDP, finance
10. Gross investment in office, computing, and accounting equipment as proportion of total investment in equipment finance

Sources:

1. U.S. Department of Commerce, Office of Business Analysis, Office of Research, Analysis, and Statistics
2. Economic Report of the President, 1984. and column 1
3. Same as 1.
4. Same as 1.
5. Economic Report of the President and column 4.
6. ~~Same as 1 and~~ Columns 3 and 4
7. ~~Same as 1~~
8. Same as 1
9. Economic Report of the President and column 8
10. Columns 7 and 8.

NET CAPITAL STOCK PER EMPLOYEE, EQUIPMENT, VARIOUS INDUSTRIES, 1950-1980

TABLE 2

	1.	2.	3.	4.	5.	6.	7.	8.	9.
1950	31.6	15.2	4184	12.1	9.4	1291	0.9	1.9	465
1955	51.9	16.9	5130	18.2	10.5	1726	2.5	2.3	1106
1960	76.1	16.8	6071	23.6	11.4	2072	4.4	2.6	1676
1965	91.6	18.1	6549	29.7	12.7	2337	8.1	3.0	2731
1970	145.6	19.4	7995	45.9	15.0	3050	15.9	3.6	4374
1975	253.4	18.3	10514	71.7	17.1	4201	39.0	4.2	9121
1980	462.6	20.4	12049	125.7	20.6	6109	90.9	5.2	17610

1. Net equipment stock, all manufacturing, billions of current dollars
2. Total manufacturing employment, millions
3. Net value of equipment stock per manufacturing employee, in dollars
4. Net equipment stock, wholesale and retail trade, billions of current dollars
5. Number of persons on payrolls, wholesale and retail trade, millions
6. Net value of equipment stock per employee, wholesale and retail trade, dollars
7. Net equipment stock, finance, insurance, and real estate, billions of current dollars
8. Number of persons on payrolls, finance, insurance, and real estate, in millions
9. Net value of equipment stock per employee, finance, insurance, and real estate, dollars.

Sources:

1. U.S. Department of Commerce, Office of Business Analysis, Office of Research, Analysis and Statistics
2. Employment and Training Report of the President, 1982
3. Columns 1 and 2
4. Same as column 1
5. Same as column 2
6. Columns 4 and 5
7. Same as column 1
8. Same as column 2
9. Columns 7 and 8

ANNUAL INVESTMENT IN EQUIPMENT AS A PROPORTION OF INDUSTRY GROSS DOMESTIC PRODUCT, CURRENT AND CONSTANT DOLLARS, 1950-1980
(ALL MANUFACTURING)
TABLE 3

	1.	2.	3.	4.	5	6
1950	3.8	7.8	83.7	131.1	4.5%	5.9%
1955	5.8	9.6	120.9	165.7	4.8%	5.8%
1960	7.2	9.7	143.8	171.8	5.0%	5.6%
1965	12.5	15.9	197.7	236.7	6.3%	6.7%
1970	16.4	17.5	252.2	261.2	6.5%	6.7%
1975	29.8	22.7	358.2	289.6	8.3%	7.8%
1976	32.7	23.2	410.4	317.4	8.0%	7.3%
1977	40.0	26.9	468.4	339.2	8.5%	7.9%
1978	44.7	28.0	518.7	357.2	8.6%	7.8%
1979	50.0	28.8	563.2	367.0	8.9%	7.8%
1980	56.4	30.2	581.5	351.0	9.7%	8.6%

Gross investment in equipment,
1. ~~Gross domestic product,~~ manufacturing, current dollars (billions)
2. ~~Gross domestic product,~~ manufacturing, constant dollars (billions of 1972 dollars)
Gross investment in equipment,
3. Gross domestic product, manufacturing, current dollars (billions)
4. " " " " , constant 1972 dollars

~~5. Gross investment in equipment, wholesale cost~~
5. Gross investment in equipment as a proportion of GDP, manufacturing, current dollars
6. " " " " " " " " , constant dollars

TABLE 3 (CONTINUED)
ANNUAL INVESTMENT IN EQUIPMENT AS A PROPORTION OF INDUSTRY GROSS DOMESTIC PRODUCT, CURRENT AND CONSTANT DOLLARS, 1950-1980

(WHOLESALE AND RETAIL TRADE)

	1	2	3	4	5	6
1950	51.3	87.5	2.0	3.1	3.9%	3.5%
1955	66.2	103.1	3.3	4.5	5.0%	4.4%
1960	84.2	117.5	3.2	3.8	3.8%	3.2%
1965	112.6	148.2	5.5	6.6	4.9%	4.5%
1970	166.5	176.4	6.5	6.8	3.9%	3.9%
1975	266.2	209.7	9.8	8.1	3.7%	3.9%
1976	291.4	220.2	11.6	9.1	4.0%	4.1%
1977	322.3	231.0	13.9	10.3	4.3%	4.5%
1978	362.3	244.6	17.4	11.9	4.8%	4.9%
1979	401.4	250.7	19.8	12.7	4.9%	5.1%
1980	428.8	246.0	19.4	11.6	4.5%	4.7%
			(FINANCE, INSURANCE, AND REAL ESTATE)			
1950	31.9	63.9	0.2	0.28	0.6%	0.4%
1955	50.0	81.8	0.65	0.84	1.3%	1.0%
1960	71.6	102.7	0.87	1.02	1.2%	1.0%
1965	98.0	128.5	1.00	1.15	1.0%	1.0%
1970	142.4	155.8	2.91	3.02	2.0%	1.9%
1975	216.2	187.9	7.77	6.77	3.6%	3.6%
1976	238.6	194.8	8.17	6.95	3.4%	3.6%
1977	275.5	207.2	10.40	8.60	3.8%	4.2%
1978	317.4	217.8	14.44	11.27	4.5%	5.2%
1979	358.3	229.4	17.71	13.33	4.9%	5.8%
1980	398.7	235.6	18.55	13.37	4.7%	5.7%

TABLE 4

Employment by major occupational group, actual 1978, and alternative projections for 1990

[Numbers in thousands]

Occupational group	1978		1990						Percentage change in employment, 1978–90		
			Low-trend		High-trend I		High-trend II		Low-trend	High-trend I	High-trend II
	Number	Percent	Number	Percent	Number	Percent	Number	Percent			
Total	97,610	100.0	119,590	100.0	127,907	100.0	121,447	100.0	22.5	31.0	24.4
White-collar workers	48,608	49.8	60,730	50.8	64,712	50.6	61,570	50.7	24.9	33.1	26.7
Professional and technical workers	15,558	15.9	20,038	16.8	21,119	16.5	20,295	16.7	28.7	35.7	30.4
Managers and administrators	8,802	9.0	10,484	8.8	11,257	8.8	10,677	8.8	19.1	27.9	21.3
Salesworkers	6,420	6.6	7,989	6.7	8,632	6.8	8,079	6.7	24.4	34.5	25.8
Clerical workers	17,818	18.3	22,219	18.6	23,705	18.5	22,519	18.5	24.7	33.0	26.4
Blue-collar workers	31,812	32.6	37,720	31.5	40,694	31.8	38,330	31.6	18.6	27.9	20.5
Craft and kindred workers	11,705	12.0	14,366	12.0	15,555	12.2	14,668	12.1	22.7	32.9	25.3
Operatives	14,205	14.6	16,399	13.7	17,697	13.8	16,584	13.7	15.4	24.6	16.8
Nonfarm laborers	5,902	6.0	6,955	5.8	7,441	5.8	7,078	5.8	17.8	26.1	19.9
Service workers	14,414	14.8	18,946	15.8	20,074	15.7	19,220	15.8	31.4	39.3	33.3
Private household workers	1,160	1.2	982	0.8	993	0.8	988	0.8	−15.4	−14.4	−14.8
Other service workers	13,254	13.6	17,965	15.0	19,081	14.9	18,232	15.0	35.5	44.0	37.6
Farmworkers	2,775	2.8	2,193	1.8	2,426	1.9	2,327	1.9	−21.0	−12.6	−16.1

NOTE: Due to rounding, sums of individual items may not equal totals.

Percent distribution of employment by major occupational group, 1982 and projected 1995

Occupational group	1982	1995		
		Low trend	Moderate trend	High trend
Total, all occupations	100.0	100.0	100.0	100.0
Professional, technical, and related workers	16.3	17.3	17.1	17.2
Managers, officials, and proprietors	9.4	9.6	9.6	9.6
Salesworkers	6.9	6.8	6.9	6.9
Clerical workers	18.8	18.8	18.9	18.9
Craft and related workers	11.4	11.6	11.6	11.6
Operatives	12.8	12.1	12.1	12.2
Service workers	16.0	16.4	16.3	16.3
Laborers, except farm	5.8	5.5	5.5	5.6
Farmers and farmworkers	2.7	1.9	1.9	1.9

SOURCES: U.S. DEPARTMENT OF LABOR, BLS, ECONOMIC PROJECTIONS TO 1990
SILVESTRI, LUKASIEWICZ, and EINSTEIN, 1983

Appendix 3

EFTE Process Materials

This appendix contains the collection of documents prepared in conjunction with the EFTE forecasting effort. Following is a brief synopsis of these to facilitate usage.

a. **Information Work Actions and the EFTE Strategy:** This preliminary paper reviews literature on office work activities. It also descrbics the process by which we arrived at the six information handling actions.

b(1). **EFTE Strategy:** This basic document describes the conceptual model for the office work forecast. It lays out actions, jobs, and sectors. It presents the estimation approach for savings, adoption, and workload.

b(2). **Some Quick Reference Information for the EFTE:** This contains the basic estimation equation and idea sheets as background to the estimations.

b(3). **'Last Word' Clarifications/Elaborations for the EFTE Forecast:** This responds to questions raised concerning the estimation process. It also lists related Georgia Tech studies.

b(4) **Round 2 Results:** These results do not feed directly into the mail round in that the estimation instructions are changed.

c(1) **Final Round Estimates Memo:** This sets out the step by step revised estimation instructions.

c(2) **Final Round Forms**

c(3) **Appendix: Background Discussion:** This discusses the rationale leading to the revised estimation instrucions.

c(4) **Savings and Workload Estimates:** This gives the raw response data from the final mail round estimations.

9/26/84

INFORMATION WORK ACTIONS AND THE EFTE STRATEGY

NOTE: This working paper assumes familiarity with the proposal for this study piece being performed for OTA.

Our present purpose is to devise a suitable functional framework to relate changes in information technology to changes in work for a broad range of office workers. We build from a prior study (Roessner *et al.*, 1984, see working paper on 'Review of Selected Studies') that yielded a set of information functions pertinent to technological innovation and to clerical work. We found there that further division of those functions was helpful in relating technological changes to what workers do (e.g., partitioning information input into structured and unstructured input).

Having determined that this study piece will not consider sales workers, our attention is directed toward managers (administrators), professional/technical workers, and clerical workers. Literature on managers suggests that the most important dimension on which to distinguish the work they do is level of responsibility (e.g., chief executive, senior manager,... first level manager).

Characterization of professionals/technicals is more complex. The Office of Personel Management defines professional occupations as "those that require knowledge in a field of science or learning characteristically acquired through education or training equivalent to a bachelor's or higher degree with major study pertinent to the specialized field." Among professionals, we concur with OTA's recommendation that the most interesting are those associated with an office environment, such as engineers, accountants, and computer specialists.

Technical occupations are typically supportive of a professional or administrative field. Clerical occupations involve structured work in support of office type operations.

We reviewed the literature at this point for three purposes:

1) to identify alternative information function frameworks perhaps more suitable to managers and professional/technical workers than that we had devised for clericals;

2) to find empirical estimates of how office workers spend their time today, especially managers and professionals;

3) to determine how best to link coming changes in information technology to office work functions.

Characterization of Information Work

One can characterize work on a variety of levels. Some emphasize Purposes -- rather lofty, abstract aims (of individual jobs, classes of jobs, and/or organizations). For instance, with respect to managers, one may speak of control, leadership, entrepreneurship, problem-solving, etc. More specific, goal-oriented behaviors have been called Tasks that one strives to do well. Again focusing on managers, tasks mentioned include: acquisition of information, budgeting, negotiating, influencing, etc. More mundane are the more readily observable Activities. These are not directly related to goals. Office workers may engage in activities such as reading, dictating, copying, and meeting. Distinctions among activities, tasks, and purposes sometimes blur. As illustrated by the attached excerpt from Lieberman *et al.*(1982), several other ways can be found to describe what office workers do.

We were particularly interested in information functions as a framework. We found a number of variations, such as:

Creation, processing, distribution, and retention (Lieberman *et al.*, 1982)

Acquisition, manipulation, documentation, dissemination (Drennan, 1983)

Initial handling, processing, utilization (Slavin, 1956)

Capture, manipulation for decision making, store, retrieve (Greenwood and Greenwood, 1984)

Search, input, validate, process, distribute (Greenwood and Greenwood, 1984).

Mintzberg (1980) and the Greenwoods suggest that managerial roles stretch beyond information work. They address three roles: information, interpersonal, and decision.

When one seeks to characterize the work of professional/technical workers, specialization of knowledge becomes a major concern. Youngman *et al.*, for instance, distinguish 14 engineering activities. Roessner *et al.*, 1984, worked with a spectrum of tasks that depicted clerical work.

As we stepped back from this array of dimensions, we sensed that the jobs fall along a continuum. For instance, characterization of functional managers (Jerkovsky, 1983) -- managers operating in a technical context -- finds them sharing attributes of managers in general and of professionals. Lieberman *et al.* (1982) distinguish various administrative assistance positions intermediate between management and clerical work. The blurring suggests to some observors combining occupations in larger groupings. An interesting one lumps managers and professionals as 'principals' (or knowledge workers) and technicians and clericals as support staff (or information workers). For the former, information handling has more of the sense of a 'means;' for the latter, ends.

In the last section of this working paper, we nominate a framework. That describes four information functions in terms of 9 actions (approximating general tasks, if you will). This set of actions seems adequate to consider what office workers,as represented by three job types, do. In choosing those job types, we kept in mind an array of worker factors that would seem to pertain to how technological change will alter work:

* How specialized the knowledge used is
* Degree to which the work is routine (programmed) vs. strategic
* Extent of interaction involved
* Whether interaction is verbal or written
* Whether work involves text or data
* Whether the focus is largely on tasks or on people.

What Office Workers Do

We have tabulated a number of estimates of how office workers actually spend their time (Table 1). These derive from diverse settings, using different methods (e.g., self-kept diaries, observation, self-estimation).

In general, the data are rather disappointing in quality and consistency of frameworks. The best generalizations appear to be

* As one progresses from clerical to professional to management, and on up the management ladder, proportionately more time is spent in communication (e.g., meetings and phone calls).

* Middle managers spend roughly half their time in meeetings or on the phone.

* On the order of 30 percent of managers' time is spent on deskwork (e.g., reading,search, analysis, calculating, writing, dictating).

* Professionals also spend substantial amounts of time in meeetings and on the phone, but not as much as managers.

* It is easiest to describe what people do in terms of

activities; it is almost impossible to do so in terms of purposes.

* Despite the attention in the literature to purposes such as decision making, description of managerial time in terms of information activities seems to suffice.

Toward An Operational Framework to Relate Tech Change to Work Actions

As discussed, we have examined various ways to characterize information work functions so that these can be related to changes in information technologies. Exhibit 1 presents the resultant strategy for use in the forecasting exercise (EFTE) to follow. This strategy combines that developed in our previous study (Roessner *et al.*, 1984) with Leontief and Duchin's (1984) three-factor approach (see the companion working paper, 'Review of Selected Studies'). We are presently in contact with them, seeking to obtain their sectoral/occupational data on these labor coefficient components for comparison with our EFTE results. The algorithm in which the estimates obtained by use of an elaborated Exhibit 1 are to be used is:

$$N = \sum_{\text{actions}} T\ ((1-A) + ASW))N_{\text{base year}}$$

where A,S, and W are as explained in Exhibit 1 and

N = number of workers in the given job type per unit of output, in some year.

T = proportion of work time in all actions devoted to a given action in the base year.

In contrast to Leontief and Duchin, we estimate for only three job types -- middle managers, professionals, and general office secretary/clerical -- and do not differentiate by sector. These three job types appear to provide the best coverage of the continuum of work activities, as discussed. More detailed coverage would appear to overload the EFTE process. As set up per Exhibit 1, participants are asked to make judgments on 9 activities at each of 2 years for 3 job types on each of W,S, and A. Each judgment is actually requested as a 3-point estimate reflecting low, high, and most likely levels of technological development and adoption. We believe this set of 162 judgments is viable. The year and job type judgments 'flow' one after the other (they are not independent), which should ease the participants' task.

The EFTE approach is predicated on having a solid information base common to a group of 'experts.' Communication within the group then serves to share expertise to yield a well-grounded projection. (Each individual is not expected to be expert on every aspect of the issue.)

To make best use of the expertise, as per the proposal, we will include several stages.

1) Preliminary mail review of background documents and estimation forms (Exhibit 1). We will explicitly ask them to identify: omissions in the work action classification, misperceptions of technology, and disagreements with the EFTE procedure.

2) Two or more estimation rounds to the point of satisfactory consensus. We will query them, in particular, regarding major changes in W incited by breakthrough technologies and/or organizational change.

3) A post-EFTE mail review of results. We will explicitly ask them to challenge findings and suggest additional factors that could lead to qualitative changes in the projections.

The set of 9 ACTIONS evolved through an iterative process. We began with reviews of what information workers do. Those emphasized the importance of observablity. Lack of empirical data that workers spend time on data base management and on planning/decision making led us to eliminate those two candidate categories. We balanced knowledge worker activities with those of support workers to arrive at the chosen actions. As discussed, the actions attempt to reflect what workers do and to be sufficiently specific with respect to technologies that could affect them.

The time estimates shown in Exhibit 1 are based largely on Lieberman *et al.* (1982) and Engel *et al.* (1979). We relied on the former heavily where discrepancies were substantial because the latter are self-estimates (known to underestimate meeting and other 'less productive' interaction times). Results correspond with the general observations that managers spend about half their time in interactive exchange, professionals somewhat less.

At this point we collapsed two categories, scheduling and travel/waiting, into in-person interactive exchange. These seem to bear most on meetings. Each averaged only 3% (and in no case exceded 5%) of the time for managers, professionals, or secretary/clerical workers.

We note that the grouping of work activities into actions is not exclusive. Copying probably supports storing information and sending information. Other activities have different implications, depending on who is performing them. Keyboarding by managers appears to relate most closely to creation of information; keyboarding by secretaries, to storage. Taking shorthand is grouped with activities pertaining to information storage based on the rationale that support staff are not 'intaking' information for their use, rather they are acting on it to store if for organizational purposes.

We note that all the resultant set of actions can be readily conceived in terms of information functions. Interpersonal and decision roles blend in with information handling actions.

There are many different ways the EFTE estimations could be formulated. Here are some of the 'paths not taken' and our reasons. We welcome counter-arguments.

1) Three jobs. The activities of knowledge workers differ considerably from those of support staff. Restricting focus to 'principals' would make the effort more homogeneous. On the other hand, we believe the ACTIONS set adequately encompasses both groups and that comparable estimates for both groups are particularly valuable for policy choices (e.g., pertaining to shifts in job opportunities). The list could be expanded to incorporate two intermediate groups - technicians and first level managers/functional managers. Because these jobs are intermediate in their action profiles, we believe the three job types to be sufficient. Two other jobs lie beyond our range -- senior managers and chief executives. These are relatively similar to each other in action profiles, are fewer in number, and extrapolate reasonably beyond middle managers.

2) Generic job types. An option not proposed would be to select more specific, 'benchmark' jobs instead. The advantage would be more detailed depiction to improve the precision of estimation. The present strategy offers dual advantages of more obvious generality and greater opportunity for imaginative identification of breakthrough possibilities (as individuals color contexts in light of their own experiences, then discuss these in the EFTE).

3) Limited job description. Alternatives would be to provide more detail, e.g., examples of tasks that, say, managers perform relative to intake of information. However, we do not have a rich store of such detail for the action/job types as per Exhibit 1 (they reflect generic composites).

4) Suggest technologies that relate to each work action. We might, instead, relate technologies to the somewhat broader information functions, or the somewhat narrower activities (see Exhibit 1). Or, we might say nothing to not bias the participants' judgments. We prefer the present 'suggestive' approach as a compromise that worked well in the previous study EFTE.

5) Base year 1980. Our time estimates are of this approximate vintage. An alternative would be to adjust them slightly and consider the base as 1984. One disadvantage of that is that certain information technologies (e.g., the word processor) have progressed rapidly during this period. That makes estimation of S (savings) and A (adoption) a bit more awkward.

6) Estimate for 1990 and for 2000. An alternative would be to estimate for only a single future point (e.g., 1998 or 2000). That would nominally reduce the estimation load in half and the more notable results will certainly be the farthest time projected. To counter this, we suggest the two estimates are not twice as much effort, rather the sequencing may help participants' develop a feel for changing technology and work patterns. In addition, perceived changes in the rate of change have policy relevance.

7) Triple estimates (for Lo, Hi, and Most Likely tech innovation). One option would be to request a single, most likely estimate. That reduces the participants' burden and gives the result of most importance. Our counter is that the triple estimate is not much harder than the single. Indeed, one may implicitly think in such terms anyway. The advantage is to yield a direct estimation of the range of uncertainty. Another option would be to perform single estimations, but for two scenarios -- a most likely tech innovation profile and a maximum, feasible innovation profile. That approach would require participants to accept our innovation projections and, probably, would entail more estimation effort on their part.

8) Estimate W, then S, then A. An obvious alternative would be to address one job at a time. That is, to estimate W,S, and A for managers, then go on to professionals. The advantage of the alternative is to keep the job estimates more independent, while linking the W,S, and A estimates. Our counter is that the job types were selected to represent points along a continuum of job attributes and that doing them in an adjoining fashion is reasonable and will yield properly consistent results.

EXHIBIT 1. PROTOCOL for ESTIMATION of the EFFECT of TECH CHANGE on WORK

Please refer to the background sheets in completing this form. These include description and forecasts of the development of the candidate information technologies. They also provide information pertinent to the likely extent of adoption, including projections of the anticipated ranges of socio-economic contextual factors.

Focus on the ACTIONS listed. Characterization of these within INFORMATION FUNCTIONS is just to help you consider general technological change patterns. Likewise, the REPRESENTATIVE ACTIVITIES that fit within the action categories should just serve to help relate work to specific current or prospective technologies.

RELATIVE BASE TIMES partition 100% of typical work times in 1980 among the 9 ACTIONS. (In reality, certain 'other' actions account for some portion of work time, but these are not of particular concern.)

The purpose of this approach is to bring to bear your tacit knowledge of how technologies will likely change the way work is performed.

ESTIMATE W (WORK AMOUNT INDEX) for each job type for each year. W means how much of each action will be required per unit of organizational output. The 1980 base is to be taken as 100.
For example, suppose you feel that technological and/or contextual change will lead to twice as much reliance on managerial search/retrieval of information in 1990 -- then enter 200 in the appropriate slot. Conversely, if you feel that technological and/or contextual change will halve the need for managers to search/retrieve information in 1990, then enter 50 in that slot.
Before making the estimates requested, please compare the definition of W to those of S and A which you will also be asked to estimate. Also, please look over the full set of ACTIONS to see how they differ.

We ask you to provide sets of 3 values for each estimation:
Lo - Lower bound on development and adoption of relevant technology.
Most Likely - All things considered, the most probable level.
Hi - Higher bound on development and adoption of relevant technology.

CANDIDATE INFORMATION TECHNOLOGIES
(> = major consideration; < = moderate)

INFORMATION FUNCTIONS	ACTIONS	REPRESENTATIVE ACTIVITIES	RELATIVE BASE TIMES Mgrs	Profs	Sec/Cler	WORD PROC	ELEC MAIL	WIDE AREA NET	FACSIMILE	VOICE RECOGN	MGR/PROF WKSTA	EXPERT SYSTEMS	...	MANAGER (Middle) 1990 L ML H	MANAGER (Middle) 2000 L ML H	PROFESSIONAL (Engr,Acct,Comp) 1990 L ML H	PROFESSIONAL (Engr,Acct,Comp) 2000 L ML H	SEC'Y/CLERCL (gen'l office) 1990 L ML H	SEC'Y/CLERCL (gen'l office) 2000 LML H
Intake	INTAKE INFO (to acquire info, to monitor)	Read Handle incoming mail	14	12	6		>	<	<		<	<							
Data Base Mgmt	STORE INFO	File/paper handling Copying Taking shorthand (Sec) Filling out forms Keyboarding (Sec)	3	5	36	>			<	>	>								
Data Base Mgmt	SEARCH/RETRIEVE INFO	File search External search	6	10	13														
Processing	EDIT/REVISE TEXT	Proofreading	3	4	8														
Processing	CALCULATE/ANALYZE DATA (to forecast, monitor, budget, etc.)	Calculate Model	5	13	5										etc.				
Communication	CREATE INFO (to decide, influence, plan)	Write Dictate (Mgr/Prof) Keyboard (Mgr/Prof)	18	17	3														
Communication	SEND INFO (written or verbal broadcast) (to influence, report)	Outgoing mail Speeches	2	2	10														
Communication	INTERACTIVE EXCHANGE OF VERBAL INFO - in person	Meetings (schdld, unschdld, confer with support staff, travel, scheduling	38	26	9														
Communication	INTERACTIVE EXCHANGE OF VERBAL Info - remote (to influence, negotiate, find info)	Telephone Teleconference	11	11	10														

EXHIBIT 1 SUPPLEMENT

1. Participants in the interactive Delphi forecast (the EFTE session) will receive 2 additional forms. These will be similar to Exhibit 1, but will address two other factors:

S (Savings) -- refers to how much work time could be saved by using the best commercially available technologies to perform the given action. Estimates are requested for 1990 and for 2000 on a scale with 100 as the 1980 time to perform a unit amount of the action (and 0 as completely automated).

For example, were all relevant technologies that could be brought to bear in a practical, commercial setting in, say, 1990 able to reduce the human time required to store information by 25 percent, then the response would be 75.

A (Adoption) -- refers to the degree to which workers in the job will make use of the innovative technology in performing the given action. This is scaled as 0 in 1980 (the base technology), to 100 as all of the action in question is performed using the improved technology.

For example, if wordprocessing with spelling and grammatical checkers constitutes the best commercially available technology for editing text, and half of all managers use this in 1990, then A = 50.

2. As mentioned in the exhibit form, supplemental information will be provided on information technologies and factors pertinent to adoption. We anticipate providing these in the form of quantitative projections, with ranges, wherever feasible. (This information will be based on the respective companion reports drafted.)

Table 1. How Office Workers Spend Their Time

Source	Setting	Subjects	Occupation	Actions (%t)			
1. Lieberman et al., 1982	--	--	1. Executive 2. Sr. Mgmt 3. Mid Mgmt 4. First-line Mgmt 5. Professionals	See appended xeroxes (major actions = mtgs., reading, writing, telephoning) e.g. - Mid Mgmt: 38 11 13 10			
		20 Sec's - 1000 Obs's (2 wk period)	6. Secretaries	diff. action set - including: typing, copying, telephoning, reception 20 11 6 5			
2. Airhart, 1982 (cited by Greenwood & Greenwood, 1984)	--	--	Knowledge Workers	Mtgs, Working (read, search, analyze,...), Ineffective (copying, arrange reserv., wait) 40 25 25			
3. Mintzberg, 1980	Lg. Orgs.	5	Chief Executives	Receive Info, Give Info, Renew Info, Strategy, Negot., Requests, Sec. 16 8 16 13 8 18 21 or Verb. Interaction, Sched. Mtgs, Unsched. Mtgs., Phone, Tours 78 59 19 6 3 Desk Work (Lg Org) 22			
Choran (1969) cited by Mintzberg	Sm Orgs.	3	Chief Executives	or Desk Work (Sm Org), Sched. Mtg., Unsched. Mtg., Phone, Tours 35 21 15 17 12			
4. Booz Allen Study (cited by Leontief & Duchin, 1984) *[as cited in Infosystems 6/82, p. 9]			Mid Mgmt	Mtgs, Create Doc's, Analyze & read, Other (includes wait, org. info., assign, sched...) 52 12 16 20 *Mtgs (incl phone), Create Doc's, Analyze, Read, Less Prod. Activities 44 13 8 8 25			
			Secretaries	Filing/Mailing/Copies/Deliver Messages & Wait for work 45			
				Interpers. Roles (% of incidents, not t)	Informat. Roles	Decisional Roles	(% of Critical Incidents-
5. Wolf, 1981	5 Account.	19	Partners (Executive)	23	20	56	data also to sub
		25	Audit Managers	26	12	62	roles & very de-
		25	Professionals (Sr. Accts)	41	14	45	tailed sub items

Table 1. How Office Workers Spend Their Time

Source	Setting	Subjects	Occupation	Actions (%t)								
				Writing	Searching	Reading	Phone	Calc	Sch Mtgs	Unsch Mtgs	Plan/Sch	Travel
6. Engel et al., 1979 (See notes too)	Corp Hqtrs (Multi-natl Firm-1700 employees) (self-estimation-weak)	76	Upper Mgrs	10	3	9	14	2	13	8.5	5	13
		123	Other Mgars	17	6	7	12	6	7	6	5.5	7
		130	Professionals	18	6	6	11	10	4	3	3	2
					Typing			Mail Hdl	Shtnd	Confer	Calend	File
		123	Secretaries	3.5	37	2	10.5	8	5.5	4	3	5
		115	Clerical Workers	7	8	3	9	10				6
				Use Terminal		Look for Info		Calc	Fill Out Forms	Check Doc's		
				6		10		10	8	10		
				Mtgs (includes telephone)		Less Product. Activs	Intellectual Work					
							Read	Analyze	Create Do			
7. Poppel, 1982	7 Manuf/8 Serv Firms	*(in prelim self-est's-90% under-est'd time for Mtgs) in depth self-recorded time samples	Mgrs Professionals Clerical Workers	SR Mgrs > 60 SI < 40	76	25	8	8	13			
				Mtgs	Telephone	Travel	Report Prep	Coord/Superv	Info Gather/Plan			
8. Talbot, 1984	TRW 'Lab'/Operational Office	20	Mgrs	57	1	4	3	24	6			
				Mtgs	Telephone	Read & Write						
9. Plummer, 1984 (city Panki, 1981-summarizing several studies)			Mgrs	50	5	25						
				Discussion incl.	Committees	Paper Wk	Inspection	Travel				
10. Stewart, 1967	Primarily lg. British manuf companies [Group based on classification by how t spent - these characterizations are rough.]	160 mgrs for 4 wks (Diary)	1) Sales Mgrs (travel a lot)	1) 54	(8)	28	4	14				
			2) Specialist Mgrs (work alone a lot)	2) 33	(4)	58	3	6				
			3) Mgrs (genl)	3) 58	(5)	35	3	4				
			4) Works (Production) 5) Mgrs	4) 5) 54	(12)	29	4	13				
11. Burns, 1957 (cited in Stewart)	6 Companies employing 500-900 people; 2 other companies' dept mgrs.	76 British top mgrs, 3-5 wks (Diary)	Top Mgrs	42-80 in discussion								
12. Horne and Lipton, 1965		66	Mid Mgrs	Talk (in own offices) - 50								

Table 1. How Office Workers Spend Their Time

Source	Setting	Subjects	Occupation	Actions (%t)					
13. Strassman, Paul (quoted by Schlefer, 1983)	[weak]	casual	Engr & Design Proj Profs	Maybe 20 on technology; most time in mtgs					
				% of contacts (not t)	Group	Indiv	Telephone	Letter	Records
14. Lawler et al.,	5 Org's (1 Manuf, 4 Soc Serv)	105 Mid & Low Lvl Mgrs (Self	34 Mid Mgrs 71 Low Lvl Mgrs	(a/e 1 manuf and 4 Soc Serv)	24	40	21	7	8
				Noninteractive commun. time (read & write)	interactive comm (conversation, mtgs, phone)				
15. Gould & Boies, 1984 (summarizing 3 others' results-incl Mintzberg & Engel)	[weak]		Principals	25	over 40				
			(Lo)	Knowledge Update	Tech Consult	Task Manager	Tech Administrate	Employee Develop	Org Develop
16. Jerkovsky, 1983		Self-est Survey	29 Lvl 2 Funct Mgrs	14	43	25	7	6	5
		(confirmed by	16 Lvl 3 " "	9	22	28	22	9	10
		Proj Mgrs' views on them)	6 Lvl 4 " "	4	13	21	38	9	16
Functional Mgrs - Engr Org. - (in charge of tech specialty orgs)(Prof Mgr, or Specialized Knowl Mgr)									
				Written or Verbal Commun					
17. Craig, (cited by Drennan, 1983, p. 75)			Mgrs	85					
			Prof/Tech	40					
			Secy/Clerical	65					
				Info Functions					
				Input	Process	Output	Data Base	Commun	Monitor
18. Roessner et al., 1984	Banking & Insurance	Computed on genl job/task description with ests of rel time rqd/function	Clericals - Banking	28	27	16	12	16	2
			Insurance	32	21	19	10	17	2
				Desk	Phone	Sch Mtg	Unsch Mtg	Tours	
19. Snyder & Glueck, 1980	1 Hosp; 1 School System	2 for 4 days each	Chief Exec's	23	6	40	18	13	

Office Automation

A MANAGER'S GUIDE FOR IMPROVED PRODUCTIVITY

Mark A. Lieberman
Gad J. Selig
John J. Walsh

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number of principals by department, and ratio of secretaries to principals and other staff members. Depending on the specific functions or areas being analyzed, additional statistics on typing, mail volumes, filing volumes and space requirements, communications, and time by job category may be required. Examples of computer and manual output forms and reports are provided in Figure 6-2 and in Tables 6-3, 6-4, and 6-5. These contain a variety of statistics covering a wide range of office activities, such as the number and distribution of telephone observations in a department, the percentage of time spent by principals at various activities, and the economics of documented administrative communications. The three examples also demonstrate that the large number of statistics that can be obtained must be carefully analyzed for meaningful conclusions and recommendations.

OFFICE SYSTEMS DEVELOPMENT METHODOLOGY

The next step in defining office systems needs and requirements and in matching the systems technologies to support these needs involves a structured approach to office systems development. A variety of approaches have been developed by IBM, N. Weinberg, E. Yourdon, A. D. Little, Inc. and others. A brief summary of the

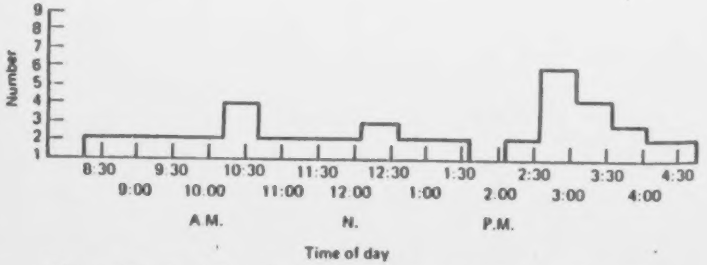

Figure 6-2 Distribution of telephone observations in a department (MIS).

Table 6-3 Principal Activities by Job Level

	Percent of Time per Week^a				
Activity	1	2	3	4	5
Writing	4.9	8.2	13.4	14.1	12.3
Dictating	8.7	3.8	2.0	0.4	0.8
Proofreading	2.5	1.3	2.4	2.0	4.3
Reading	20.7	11.9	11.3	8.4	9.5
Incoming mail handling	2.5	3.9	4.0	6.1	3.8
File handling	1.6	0.6	1.3	2.3	3.5
Other Paper handling	1.1	0.7	0.8	1.5	2.1
Searching for information	1.0	2.2	3.5	5.6	6.4
Copying	0.2	0.6	1.0	1.8	2.0
Calculating	3.9	2.6	4.2	5.6	13.2
Scheduling	0.6	0.8	2.4	3.1	2.5
Telephoning	9.8	7.2	10.2	13.1	11.0
Typing	1.1	0.2	0.3	2.1	1.9
Meetings	38.2	47.1	37.5	28.1	20.6
Travel	2.1	3.1	2.0	1.0	0.9
Waiting	1.1	1.7	1.3	1.5	2.0
Other	—	4.1	2.4	3.3	3.2
	100.0%	100.0%	100.0%	100.0%	100.0%
Total hours^b	43.0	44.2	43.5	37.5	38.5

[a] Column designations are: 1 = executive; 2 = senior management; 3 = middle management; 4 = first-line management; 5 = professionals; based on a 15% sample size.

[b] Excludes lunch time.

Table 6-4

Activity	Percent of Time
Typing	20.2
Dictation	4.6
Telephoning	5.6
Scheduling	1.3
Follow-up	1.2
Mail	3.5
Filing	4.2
Copying	10.7
Coffee break	3.2
Lunch	12.4
Statistical work	1.2
Distribution	4.0
Reception and errands	5.2
Personal work	0.8
Record keeping	1.2
Special projects	6.0
Supplies	0.6
Other	14.1
	100.0%

*Sample = 20 secretaries; 1000 observations, 2-week period.

Table 6-5 Filed Document Sampling at a Typical Corporate Headquarters

Document Description	Percent of File Documents
Type	
Letter	15.8%
Memo	15.2
Computer report	2.1
Typed report	13.7
Form	17.7
Teletype, Telex	1.8

Table 6-5 File Document Sampling at a Typical Corporate Headquarters

Document Description	Percent of File Documents
Procedures bulletins, manuals	5.9
Annual report	1.1
Magazine	1.0
Book	0.7
Newspaper	0.4
Article, clipping	2.4
Brochure	3.7
List	4.4
Work notes	1.8
Press release	0.2
Other	11.9
Total	100.0%
Age (In Months)	
Mean	39.1
Median	23
Number Of Pages	
Mean	9.4
Median	1
Size	
8½ × 5½	1.3
8½ × 11	87.4
8½ × 14	2.9
11 × 14	1.0
Other	7.4
Total	100.0%
Kind of Copy	
Original	16.1
Machine Copy	45.9
Carbon Copy	6.8
Other	31.2
Total	100.0%

Table B-1 Automated Office Systems: Summary of Functional Matrices

		Creation		Processing (Change)		Distribution (Dissemination)		Retention (Search Retrieval, Disposal)	
Job Type	Overall Potential	Potential	Function	Potential	Function	Potential	Function	Potential	Function
Chief executive officer (CEO)	Low	Low	Speeches Presentations Decisions	Low	—	Low	—	Low	—
Vice president (VP)	Modest	Low	Reports Correspondence Decisions	Modest	—	Modest	—	Low	—
Upper management (general manager/director)	Moderate	Moderate	Reports Schedules Correspondence Decisions	Moderate	Productivity data Cost data Budgets Forecasts/plans What-if analysis	Moderate	Reports Strategy Plans Orders	Good	Data Various documents
Middle management (director and manager)	Good	Moderate	Reports Orders Decisions	Good	Productivity data Budgets Costs Status reports Correspondence What-if's	Good	Reports Orders	Good	Data Various documents
Professional/paraprofessional/technical	High	Good	Reports	Good	Various data	High	Reports	High	Documents
Executive secretary (administrative and nonadministrative)	Moderate	Good	Schedules Reports Correspondence Telephones	Moderate	Schedules Correspondence Mail Telephone	Good	Various	Moderate	Documents Reports
Manager secretary (general manager/director)	High	Good	Schedules Reports Correspondence Telephones Dictation	High	Schedules Budgets Correspondence Reports Mail Telephone	Good	Various	High	Reports Data Various data

Table B-1 Automated *(Continued)*

		Creation		Processing (Change)		Distribution (Dissemination)		Retention (Search Retrieval, Disposal)	
Job Type	Overall Potential	Potential	Function	Potential	Function	Potential	Function	Potential	Function
Administrative secretary (director/ manager)	High	Good	Dictation Reports Verbal	High	Reports Schedules Mail Telephone Orders	High	Various	High	Documents Reports
Office worker	High	Good	Reports Correspondence Verbal	Good	Data Reports	Good	Various	High	Files
Clerk/typist	Good	Good	Dictation Handwritten reports	Good	Various	Good	Various	Low	Files

Table B-2 Office Systems: Functional Matrix—Information Creation (Includes Capture & Preparation)

Job Type	What	From	How	Frequency	Volume	Potential
Chief executive officer (CEO)	Policy statements Public statements Directives/orders/ regulations Personal correspondence Operating statements	Stockholders Board members Financial and commercial Government agencies Associates	Verbal Mail* Telephone* Reports* Conferences*	Multiple times/weeks	Low	Low
Administrative executive secretary	Schedules/calendar Letters/memos Meetings	CEO Subordinate(s)	Handwritten Typed* Telephone*	Active and on demand/ reactive	Modest	Good
Vice president (VP)	Policy Procedures Directives/orders Personal correspondence	CEO Organization reporting to him/her Peers	Verbal Review/approve Mail* Reports* Conferences*	Multiple times/day	Modest	Modest
Executive secretary	Schedules/calendar Letters/memos Reports Follow-up	Vice president	Typed* Telephone* Verbal Dictation*	On demand/ reactive	Moderate	Good

Table B-2 *(Continued)*

Job Type	What	From	How	Frequency	Volume	Potential
Upper management (general manager/ director)	Reports Orders Memos Personal correspondence Strategies	Vice president/ director Peers Reporting Organization	Verbal Reports* Mail* Telephone* conference*	Multiple times/day	Moderate	Moderate
Director/ general manager secretary	Schedules Letters/memos Minutes Reports	General manager/ director	Typed* Telephone* Verbal* Dictation*	On demand/ reactive	High	Good
Middle management (director/ manager)	Reports Operational decisions Orders Memos	Superiors Peers Reporting Organizations	Handwritten Verbal Reports* Mail* Conferences*	Multiple times/day	Moderate	Good
Administrative secretary	Schedules Reports Documents for Retention	Professional Paraprofessional	Typed* Telephone* Handwritten Dictation*	On demand/ reactive	Moderate	Good
Professional/ Paraprofessional/ technical	Reports Proposals	Superiors Peers	Reports* Mail* Verbal	On demand/ reactive	Moderate	High
Office manager	Reports	Superiors	Typed* Handwritten* Verbal	On demand	High	High
Clerk/typist	Various (few)	Various	Typed* Verbal	High	High	Modest

*Functions being addressed by the automated office of the future.

Table 8-3 Office Systems: Functional Matrix
Process—Processing (Includes Change and Expansion)

Job Type	What	How	Frequency	Volume	Potential
Chief executive office (CEO)	Policy items Strategies Financials	Assimilation Creativity Mental	Multiple times/month	Low	Low
Administrative executive secretary	Expedites/routes Reports Coordinate responses Schedules Priorities	By hand* Typed* Copy*	Active/reactive on demand	Modest	Moderate
Vice president (VP)	Budgets/books Strategies/plans	Mental What if-ing	Multiple times/month	Low	Moderate
Executive secretary	Expedites/report Schedules Mail priority Phone priority	By hand* Typed* Copy*	Multiple times/day	Moderate	Good
Upper Management (General manager/director)	Productivity figures Budget/costing data Forecasts/plans Mental/what-if-ing	CPU application* Calculator* By hand* Mental	Multiple times/month	Modest	Moderate
General manager/director secretary	Expedites reports Schedules Mail priority Telephone priority	By hand* Typed* Copy*	Multiple times/day	Moderate	High
Middle management (Director/manager)	Productivity figures Cost data Industry reports Status reports	CPU application* Calculator* By hand* Mental	Multiple times/month	Moderate	Good
Administrative secretary	Expedites reports Schedules Mail phone priority Orders	By hand* Typed* Copy*	Multiple times/day	High	High
Professional/paraprofessional/technical	Raw data from various sources	By hand Calculator* Terminal* Personal composition* Mental Copy*	Multiple times/day	High	Good

Table B-3 *(Continued)*

Job Type	What	How	Frequency	Volume	Potential
Office worker	Various numbers/data	By hand* Calculator* Copy*	Multiple times/day	High	High
Clerk/typist	Little	Typewriter*	High	High	High

*Functions being addressed by automated office of the future.

Table B-4 Office Systems: Functional Matrix—Distribution (Includes Dissemination)

Job Type	What	To	How	Frequency	Volume	Potential
Chief executive officer (CEO)	Annual reports Policies Personal correspondence Speeches	Stockholders Board members Financial/ industry Community Government agencies Accountants	Printed report* Personal stationery* Company letterhead* Personal notes* Verbal Dictation*	Multiple times/month	Low	Low
Administrative executive secretary	Various	Various	Verbal Type* Telex*	Multiple times/day	High	Moderate
Vice presidents (VP)	Policies/guidelines Orders Speeches Personal correspondence Associates	CEO Peers Reporting organizations Industry/ community Personal dictation	Personal stationery* Company letterhead* Personal notes* Verbal	Multiple times/month	Low	Low
Executive secretary	Various	Various	Verbal Typed*	Multiple times/day	High	Good

Table B-4 *(Continued)*

Job Type	What	To	How	Frequency	Volume	Potential
Upper management (general manager director)	Reports Orders Strategies Memos Personal correspondence	Superiors Subordinates Peers/associates	Company letterhead* Memo paper* Verbal Personal dictation*	Multiple times/week	Modest	Moderate
Manager secretary (General manager/ director)	Various	Various	Verbal Typed*	Multiple times/day	High	Good
Middle management (director/ manager)	Reports/analysis Orders	Superiors Subordinates Peers/associates	Computer printout* Verbal* Dictation*	Multiple times/week	Moderate	Good
Administrative secretary	Various	Various	Verbal* Typed* Handwritten Telex* Facsimile*	Many times/day	High	High
Professional/ Paraprofessional, Technical	Documents/manuals Reports	Superiors Subordinates	Computer output* Verbal	Multiple times/week	High	High
Office worker	Various	Superiors	Handwritten Typed*	Many times/day	High	Good
Clerk/typist	Letters Memos	Author	Typed*	Many times/day	High	Good

*Functions being addressed by automated office of the future.

Table B-5 Office Systems: Functional Matrix—Process Retention (Includes Search, Storage, Retrieval and Disposal)

Job Type	Source	What	How	Amount	Maximum Speed of Referral Needed	Needed Duration	Actual Duration	Potential
Chief executive officer (CEO)	Board of directors SEC/ Government Agencies Industry/ professional & management organizations	Reports/ articles Personal correspondence	File cabinets Security—good	Low	Fast	1–12 months	2–4 years	Low
Administrative executive secretary	Superior	Correspondence (active) Reports Records Schedules	File cabinets* Security—good	Low	Fast	1 day–12 months	1–4 years	Modest
Vice president (VP)	Reporting organization Industry associations Peers	Performance reports Strategy documents Personal correspondence Financial reports	File cabinets Security—good	Low	Within 15–60 minutes	1–12 months	2–4 years	Modest
Executive secretary	Superior	Correspondence Reports Records Schedules	File cabinets* Security—good	Low	Fast	1 day–12 months	1 day–4 years	Moderate
Upper management (general manager/ director)	Superiors Subordinates Peers Industry	Budget/cost data Personnal records Performance data Project reports Industry reports Correspondence Miscellaneous	File cabinets* Security—modest	High	15 minutes	6–24 months	1–3 years	Moderate

Table B-5 *(Continued)*

Job Type	Source	What	How	Amount	Maximum Speed of Referral Needed	Needed Duration	Actual Duration	Potential
Manager secretary Director/general manager	Superior	Correspondence Reports	File cabinets* Security—good	Low	Within 5–15 minutes	1 day–12 months	1 day–4 years	Good
Middle management (director/manager)	Superiors Subordinates Peers Industry	Budget/cost data Personnel records Performance data Project reports Policy/technical manuals Correspondence	File cabinets* Security—poor On-line storage Archives* Vaults	High	Within 15 minutes	3–24 months	1–2 years Up to 6 years for vital records	Good
Professional/paraprofessional/technical	Superiors Peers Industry	Raw Data Reports/correspondence Project data	File cabinets* On-line storage* Security—poor	Very high	Within 1 minute Fast as needed	1–6 months	1–2 years	High
Administrative secretary	Various	Various	File cabinets* Security—poor	Very high	Fast	1 day–12 months	6–24 months	High
Office worker	Various	Various	File cabinets* Security—poor	Moderate	Moderate 5–60 minutes	1 day–6 months	6–24 months	High
Clerk/typist	Various	Various	File cabinets* Security—poor	Low	Within 6 hours	1 day–2 months	1 week–1 year	Good

*Functions being addressed by automated office of the future.

(6)

In developing a prototype of an office communications system, an office study was first done to specify requirements for the prototype. The study focused on the productivity of three groups of employees: principals, clerical personnel, and secretaries. With requirements set by the management of the office used as a framework, application requirements for end users of an office communications system were established. From a subset of these requirements the prototype was developed.

The prototype system was designed as an experimental learning system to provide managers and professionals with an easy, fast, and direct method for handling their business communications. The prototype was set up on IBM premises for testing and evaluation. Results of this operation are included in the discussion.

An office communications system

by G. H. Engel, J. Groppuso, R. A. Lowenstein, and W. G. Traub

The term "office automation" generally refers to the machine-aided creation, communication, storage, retrieval, and control of messages and documents handled by professional, clerical, and secretarial personnel in an office environment. Motivated by the conviction that "office automation demands that the new office machines be linked together to form integrated systems,"[1] an office study was begun in 1975 by IBM's Data Processing Division in connection with one of its customers. The purpose of the study was to investigate requirements for an integrated office communications system and to provide a framework for developing a prototype of such a system.

For this study, an office communications system was defined as a computer-based system that provides integrated facilities for the processing of business communications more efficiently and economically with little or no use of paper records. An objective of the study and prototype was to find ways to increase the return on the investment in office personnel by handling a broad class of functions through terminal work stations, with increased labor

1 Principal activity summary

Activities	Average percent of time*			
	Level 1	Level 2	Level 3	All
ing	9.8	17.2	17.0	15.6
il handling	6.1	5.0	2.7	4.4
ofreading	1.0	2.5	2.4	2.3
rching	5.0	6.4	6.4	5.6
ading	8.7	7.4	6.5	7.3
ing	1.1	2.0	2.5	2.0
rieving filed information	1.0	3.7	4.3	3.6
tating to secretary	4.9	1.7	0.4	1.9
tating to a machine	1.0	0.9	0.0	0.6
lephone	13.8	12.5	11.3	12.5
lculating	2.5	5.0	9.6	6.6
nferring with secretary	2.9	2.1	1.0	1.8
heduled meetings	13.1	6.7	5.0	7.0
scheduled meetings	0.5	5.7	3.4	5.4
anning or scheduling	4.5	5.5	2.9	4.3
aveling outside HQ	15.1	6.6	2.2	6.4
pying	0.1	0.6	1.4	0.9
ing equipment	0.1	1.5	9.9	4.4
her	3.3	6.7	11.6	7.7
	100	100	100	100
al number of principals	76	123	130	329

el 1 represents upper management
el 2 represents other managers and management-equivalent personnel
el 3 represents nonmanagerial personnel

productivity and improvement in the quality of activities performed.

In this paper, the study is first described. Included are the major factors involved and the resulting requirements that led to development of the prototype. In the discussion of the prototype which then follows, the objectives of the system, its setup and installation, and its operational characteristics are covered. Finally, some of the results derived from the prototype operation are presented.

The office study

Our study partner was a multinational corporation with a consumer and industrial product line. The study site was the corporate and divisional headquarters for this company, where over 1,500 people were employed in a traditional decentralized administrative environment.

In the early stages of the study, it became evident that if we were to define a system that would help the office, it was important to know what people did with their time. Thus, the activities of three

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groups of employees were examined: secretaries, clerical workers, and principals (which included both managerial and professional exempt personnel). People in each group were given questionnaires that asked them, among other things, to estimate the amount of time they spent in various activities. These estimates are summarized in the tables that are included. A word about each may be useful in order to understand some of the requirements that would be derived for this system.

principals

Activities among principals generally appeared to be consistent with the levels of the people responding (see Table 1). For example, scheduled meetings, unscheduled meetings, and travel, with 13.1, 8.5, and 13.1 percent, respectively, were very prominent activities among upper-management respondents. In contrast, more administratively oriented activities, such as filing, searching, and retrieving, were more evident among nonmanagement people (13.2 percent).

Upper-level management appeared to avoid administrative work and concentrate on communications-oriented activities. Their ability to avoid administrative work appeared to depend on the degree of support they received from subordinates and on the percentage of their work delegated to these people.

Even so, there was evidence that even more work could have been delegated if the proper people or systems were available. When asked if there were tasks that they do now that others could do for them, 51 percent of the principals indicated that they had one or more such delegable tasks. At the time this study was made, principals were spending 14 percent of their work month doing tasks that, in their opinion, others could do for them. Our analysis of these tasks showed that many of them could be done by less highly compensated people and involved such activities as copying, calculating, assembling data, typing, covering telephones, and filing and retrieving documents. In many cases, (45 percent of the time) the tasks would have to be done by other principals. However, trained secretaries or clerical workers could do 55 percent of the delegable tasks.

Table 2 Secretarial activity summary

Activities	*Average percent of time*
Writing	3.5
Mail handling	8.1
Bulk envelope stuffing	1.4
Collating sorting	2.6
Proofreading	3.9
Reading	1.7
Typing	37.0
Telephone	10.5
Copying or duplication	6.2
Conferring with principals	4.3
Taking shorthand	5.5
Filing	4.6
Pulling files	2.8
Keeping calendars	2.6
Pick up or delivery	2.2
Using equipment	1.3
Other	2.0
	100
Total number of secretaries	125

secretaries and clerical workers

This led to an analysis of secretarial and clerical activities to determine what these people were doing and where savings might be made.

Among the secretaries, typing was by far the number one activity. But it varied with the number of principals supported by a secretary (see Table 2). Thus, private secretaries supporting a single professional estimated that they spent only 26 percent of their time typing. By contrast, secretaries who supported more than four principals estimated that 45 percent of their time was devoted to typing.

With the extra time available to them, it appears that private secretaries do more administrative work, such as conferring with their manager, keeping calendars, taking shorthand, and handling mail.

On the other hand, secretaries with heavy typing workloads had time for little else. To the extent that their typing productivity is improved, they will have more time available for administrative support of principals or more time for typing—if that's what's needed.

Clerical activities did not fit any single pattern, other than to show that at least 41.9 percent and as much as 58 percent of the time is spent in paper handling (see Table 3).

information flow

In addition to understanding what people did with their time, a considerable amount of study activity was devoted to understanding the paperwork process within the company. For example, conventional business correspondence—letters and memos—were sampled to determine where they were coming from and where they were going. The results are shown in Table 4. The pattern that emerged, on both the incoming and outgoing side, was that a substantial amount of the paper stayed within the company: 75 percent of the incoming letters and memos originated within the company and 81 percent of the outgoing documents remained within the company.

A lot of time was spent in copying, and we found that for each original, six copies were made on average. Most of these were machine copies and the time devoted to making them was very much disliked by the secretaries. It was also partly unproductive time in that it involved traveling to and from the copiers, waiting for them to become available, and not infrequently finding them to be out of service.

management requirements

Although the data collected provided an interesting statistical picture of the company studied, a large part of our understanding of the organization, and the direction in which it wanted to move, came from interviews with employees, who ranged from clerical personnel and secretaries to corporate executives.

From the management team, in particular, we were able to derive a set of company office system requirements or objectives that were to guide us throughout the study. These objectives were:

1. Increase professional and managerial productivity.
2. Grow in stages.
3. Fit within the existing organization.
4. Tie in to data processing applications.

Table 3 Clerical activity summary

Activities	Average percent of time
Filling out forms*	8.3
Writing*	7.3
Typing*	7.8
Collating sorting*	5.2
Checking documents*	10.4
Reading*	2.9
Filing*	5.9
Looking for information*	10.2
Telephone	9.2
Copying or duplicating	3.9
Calculating	10.3
Meetings	1.9
Pick up or delivery in HQ	0.8
Scheduling or dispatching	1.2
Using a terminal	6.3
Other	8.4
Total	100
Total number of clerical personnel	115

*Primary paper handling activities (39.0 percent)

*Secondary paper handling activities (cumulative total = 58 percent)

In deriving the first objective, we found that the exempt population at the customer site was twice as large as the nonexempt population, which was composed mainly of secretaries and clerical workers. The customer was at a point where the exempt staff output was not increasing at the rate that other areas in the company were increasing. Something was needed—equipment, procedures, other motivators—that would allow these people to become more productive.

This reason was the primary motivation for this customer's interest in office communication systems. Not only were there twice as many exempt employees as others, but their total cost was more than four times the nonexempt labor cost. Thus, even small productivity gains might have had high value to the customer.

This is not to say that the customer was not interested in improving secretarial productivity; they were, but not as an end in itself. Thus, they accepted the idea that to increase principal productivity, it might be necessary to first improve that of the secretaries so that they could provide better support to principals by either handling an increased typing workload or accepting more administrative work.

For the second objective, we found that to achieve maximum value from an office communications system, almost all company locations would need access to it, and most employees in those locations would have to become users. Great risk would thus be involved. Not only might such a system be potentially expensive, but the application itself was untried and untested and the question of user acceptance of an office system had not been answered.

The customer was committed to minimizing these risks and felt that an office system would have to grow in stages, starting in departments with potentially high value before moving to other departments and locations. In this way, the financial risk would not only be minimized, but as the state of the art advanced, the company would be able to take advantage of new technological breakthroughs as they occurred, provided the communications interface was defined.

Concurrent with the concept of growing in stages, the customer was also anxious to avoid disruption of their established organization by introduction of office communications system concepts. As a matter of philosophy, they wanted the system to fit the users and not the reverse, thus providing the third objective. Practically speaking, they wished to avoid clustering the secretaries into groupings simply because of the physical limitations of the machines (such as cable lengths) or because the economics of the system required grouping in order to reduce work station costs.

Table 4 Document flow

Copies of outgoing documents	First two combined	First three combined	First four combined
30% to dept. files			
19% routed in dept	49%		
18% other HQ dept		67%	
14% other company locations			81%
19% outside company			
Incoming letters and memos			
7% from same dept			
10% other HQ depts	17%		
58% other company locations		75%	
25% outside company			100%

This desire did not mean that the customer would not accept a reorganization in order to achieve efficiency of operation; however, it was clearly indicated that such a reorganization would be a by-product of an office communications system, rather than a prerequisite to such an installation.

In deriving the fourth objective, we observed that this customer was aware, as are many others, that employees who were not working in data processing were becoming more and more familiar with computer concepts. Many of those employees were in touch with data processing daily. At the very least, they were providing input to or receiving output from computers.

The real revolution, however, was occurring among a smaller group of noncomputer professionals who were doing terminal data entry or inquiry. They were the forerunners of the on-line office system users.

They, and their managers, realized that office communications, to be meaningful, would involve not only access to text documents, but also integration with data processing applications as well. The more prescient users could foresee a single user interface to all computer applications. At the very least, each user would have a single physical terminal connected to all systems.

application requirements

With the management requirements as a framework, the study team proceeded to define application requirements for end users of an office communications system. These requirements would become the basis for system design and development for a prototype office communications system. The major functional areas are now described.

EFTE Strategy

You have been asked to participate in an effort to forecast the effects of Office Automation technology on the nature of white collar jobs for the remainder of this century. This study, conducted by the Georgia Institute of Technology Office of Interdisciplinary Programs on behalf of the U.S Congress' Office of Technology Assessment, consists of a number of interrelated parts. An important component is the EFTE expert opinion survey in which you are about to participate.

This paper will provide background information explaining:

1> the **conceptual model** of Office Automation implicit in the opinion capture process used.
2> the **EFTE Survey**, a newly-developed opinion capture technique to be used in this study.

Detailed background information on technologies, Office Automation adoption trends, and other important **Context** information is attached.

The Conceptual Model of Office Automation

A wealth of literature describing office work was examined in the preliminary investigations of this study. The literature examined provided alternate methods for classifying office personnel and alternate methods for dividing office workers' time. As might be expected, different literature sources paint different pictures of the office worker. For the most part, no "common denominator" exists for transforming the various data available into a single coherent structure for comparison. However, there do exist some rough correlations among a number of the studies. For more details on these studies, working papers entitled *Reviews of Selected Studies that Project Office Automation Effects on Work* and *Information Work Actions and the EFTE Strategy* are available.

The model developed for this study is rooted in studies by Roessner et al. and Leontief and Duchin. The time data presented in this research draws heavily from Lieberman, Selig, and Walsh and from Engle. The model is a simple matrix process structured on:

1> a set of **job ACTIONs** developed to describe the activities of the office environment.
2> a set of generic **JOB types** that approximate the variety of office job descriptions.
3> a set of **industrial and service SECTORs** that encompass a majority of the white collar work force.

Within the matrix structure defined by ACTIONs, JOBs, and SECTORs, you will be asked to assess the manner in which three parameters will change as a function of technological advancement. These parameters are:

S> the manner in which Office Automation technology will **SAVE** time in accomplishing a fixed amount of office work.
A> the rate at which pertinent Office Automation technologies will be **ADOPTED.**
W> the manner in which Office Automation technologies will alter the **WORKLOAD** per unit output by JOB and ACTION.

This matrix approach is illustrated in **Figure 1.** The structures and parameters are described in greater detail below.

Algebraically, the model is expressed by **Equation 1.** Note that the **S**avings parameter is indexed by *time* and *action*; the **A**doption parameter is indexed by *time*, *action*, and *Sector*; and the **W**ork parameter is indexed by *time*, *action*, and *job*. The parentheses are included in **Equation 1** to group the terms in an intuitively appealing form. ($\mathrm{WORK}_{1980,a,j,s} * W_{t,a,j}$) generates the amount of time consumed by a worker in JOB *j* in ACTION *a*, in the year *t*. The projection of workload is then reduced by the factors for time SAVINGs due to technology and for technology ADOPTION.

The following sections will provide information on the development of the matrix structure and of the S, A, and W parameters.

ACTIONs

A variety of strategies have been used in the literature to describe the work of the office worker. Several approaches seem to dominate. A number of studies focus on observable and measurable "activities". Such studies will tell you, for example, that a manager spend 1.5% of his time TYPING (but does not tell you what or why he is typing). Other studies summarize results by "information functions." A secretary's time may be divided among several information functions (for example, INPUT, OUTPUT, PROCESSING, etc.). Although it is difficult to establish current %-of-time data under information functions, such an approach is helpful in assessing possible effects of future Office Automation developments. Finally, some studies divide time for managers by classic "management functions" (e.g., MOTIVATE, CONTROL, PLAN, DECIDE, etc.). Again, this approach is extremely difficult to quantify and measure. It does, however, provide a basis for deciding which portions of the management task are "automatable."

After reviewing the literature offerings and finding none appropriate for the research at hand, we developed a set of **ACTIONs** to describe office work. Although concepts from previous studies were frequently used, they were often modified to meet our criteria for the list of ACTIONs:

1> Measurement and Intuitive Appeal. The list should be based on observable and measurable activities.
2> Technology and Automation Potential. The list

must facilitate an understanding of the relationship between office work and Office Automation technologies.

3> Managerial Functions. The structure should provide some insight into managerial functions.

4> Brevity. The fewer ACTIONs in the office work structure, the less laborious and time-consuming the expert opinion process. Thus, there must be a judicious balance between detail and brevity in designing the structure.

Table 1 contains a list of our office work ACTIONs.

JOB Types

Another axis of our office work matrix is the type of JOB or the job description. A small but representative set of office-bound JOBs is required. The following generic categories will be used in the EFTE Survey:

1> **Middle Manager.** This category addresses a large group of office workers who are neither at the very top nor the very bottom of the corporate managerial ladder. Much of their work entails the transferring and the transforming of information within the company's environment. Their responsibilities are less strategic than senior level management, but are more long-term than those of the first-line manager. Note the time profile provided under "Activities" in **Table 1.**

2> **Professional.** This JOB represents the non-management office worker who is employed because of special technical skills and knowledge. Included in this JOB are engineers, computer specialists, accountants, and the like. Also profiled in **Table 1**, the professional is characterized by their expertise, autonomy, and association with their professional community.

3> **General Secretary/Clerk.** This JOB typifies a variety of clerical occupations similar to the general secretary (serving more than one manager/professional) and the skilled office clerk.

Again, more JOBs could be added for a higher "resolution" in the final output of the model. However, given the matrix nature of the model, increasing the number of JOBs greatly increases the number of estimates required of the EFTE participants.

SECTORs

One of the variable parameters to be assessed in the expert opinion portion of the research is the rate at which the available technology is adopted. Rates of adoption are inconsistent among industries due to economic and management differences. Thus, the following list of industry SECTORs is used in this study. Realize that the brevity concern expressed in the ACTIONs discussion also applies to SECTORs.

1> **Agriculture, Mining, and Construction.**
2> **Manufacturing.**
3> **Transportation and Utilities.**
4> **Communications.**
5> **Wholesale and Retail Trade.**
6> **Banking, Finance, Insurance, and Real Estate.**
7> **Service.**
8> **Public Administration.**

S(avings) Parameter

The first parameter to be estimated in the expert opinion process is the SAVINGs parameter. A primary impact of Office Automation technology is its ability to increase the productivity of an office worker in some job-related activity. Thus, to project the overall effects of this technology on office work, we must be attuned to how technology improves office productivity. This is the function of the S parameter.

In the EFTE process, we will participants to examine each of the job ACTIONs we have defined (see **Table 1**). A level of output for each ACTION will be assumed for the 1980 base year. This output level is designated "100%." EFTE participants are asked to estimate the MAXIMUM productivity improvements due to Office Automation technology for a specified year (say, 1990) by estimating the relative amount of time required to perform the 1980 base year workload. In other words, if an EFTE participant feels that an office worker with 1990 state-of-the-art equipment can perform the same amount of work he did in 1980 in one quarter the time, the participant will respond with "25%." This judgment will be made for each of the ACTIONs.

A(doption) Parameter

Another key factor in estimating the impact of Office Automation technology on office work is the rate at which new technologies will be adopted. The A parameter addresses this issue. In this model, ADOPTION is considered to be a function of the ACTION and the SECTOR. ADOPTION is driven by a number of factors, including hardware/software capabilities, cost/benefits, behavioral considerations, economic influences, perceived need, and managerial priorities.

To avoid the workload and the possible confusion that would be created by asking EFTE participants to generate **A** estimates for each ACTION-SECTOR combination (e.g. 6 x 8 = 48 estimates), a matrix multiplication approach will be taken. Participants will be asked to estimate a set of general factors for ACTIONs (6 estimates) and then estimate a set of general factors for SECTORs (8 estimates). These estimates (6 + 8 = 14 estimates, total) will be cross multiplied to generate the 48 individual estimates desired.

For the ACTION estimate, we ask EFTE participants to respond on a scale of "0%" to "100%". For an ACTION, a response of 100% indicates a very high liklihood that the associated Office Automation technology will be adopted. A response of 0% indicates an expectation of little or no further adoption of related technologies.

For the SECTOR estimate, EFTE participants will also respond on a 0% to 100% scale. In this case, the 100% means that the SECTOR is expected to adopt all available state-of-the-art technologies during the year in question. Conversely, a response of 0% indicates that the SECTOR will still be using the same technologies as in the 1980 base year.

W(orkload) Parameter

Unlike the S and A parameters, the **W** parameter may show an increase or a decrease. This parameter may well be the most difficult to estimate. The S and A parameters are components of the model addressing the effects of technology on office productivity. They are used to forecast how much time will be saved by Office Automation technology for a constant amount of work (at the ACTION level). Note, however, that the introduction of various technologies may increase or decrease the amount of work for a given ACTION. For example, with new technolgies in place in 1990, there may be less PROCESSING workload but more INFORMATION INTAKE workload for a manager. The W parameter is expected to reflect these gross changes in the nature of work.

We ask EFTE participants to respond with a W forecast for each ACTION-JOB combination (6 x 3 = 18 estimates). The responses could range from 0% to "Infinity". A response of 0% means that there will be no workload for that ACTION in that JOB for the year in question. A response of 100% indicates no change from the 1980 base (e.g., the same amount of "in-basket" material for a secretary to type). A response greater than 100% forecasts an increase in the required workload (for the 1980 based output) for the stated ACTION-JOB in the designated year.

The EFTE Process and General Description

EFTE is an expert opinion process developed by Nelms and Porter in a similiar research project on Office Automation. An expert opinion capture derivative of the Delphi technique, EFTE stands for Estimate-Feedback-Talk-Estimate Technique. EFTE is an "Interactive Delphi," combining desirable feedback and anonimity features of the Delphi with the flexibility of an open discussion. More detailed information regarding the theory and development of the EFTE is available in the form of an article by Nelms and Porter to be published in *Technological Forecasting and Social Change.*

The EFTE Procedure

The basic process of EFTE is as follows:

1> **Context.** EFTE participants are provided with background information to be read and assimilated before the EFTE meeting. In this case, the Context includes information on Office Automation technologies, adoption rates and factors, and EFTE structure and procedures.

2> **Estimate.** The EFTE participants gather for the EFTE event. Note that this is a divergence from the normal Delphi procedure in which participants respond by mail and are not aware of who the other participants are. Respondents are given an opportunity to question the **EFTE manager** about questions of procedure and Context content. Discussion among participants is discouraged at this point. Then, the EFTE questionnaires are distributed and the first Estimate round is performed. Once they have completed the questionaires, participants give the questionnaires to the EFTE Manager for compilation.

3> **Feedback.** The first estimate questionnaires are quickly analyzed and summaries are provided to the EFTE particpants as Feedback. Note that this occurs almost immediately after the last participants complete their questionnaires. Feedback may be in the form of poster-sized charts that can be displayed for the entire group simultaneously.

4> **Talk.** The EFTE participants are now given an opportunity to discuss the feedback results. Questions are posed (anonymously through index cards submitted to the EFTE Manager, if desired) based on the feedback. The EFTE participants are allowed to discuss their opinions and share perspectives from their alternate areas of expertise.

5> **Estimate.** After the Talk phase discussion is completed, the participants perform a second Estimate round in which they make fresh judgments based on their knowledge and insight gained in the Talk phase discussion. As before, the questionnaires are promptly summarized for display and discussion.

6> **Iteration.** The Estimate-Feedback-Talk-Estimate process is iterated until the responses reach a reasonable level of stability. Note that consensus is not required (as it is in Delphi).

7> **Follow-up.** Within two weeks of the EFTE event, a summary of the findings is distributed to the participants for review and comment. Participants are asked to return any observations or comments that might aid in using the EFTE results.

EFTE has several positive attributes that make it appropriate for this research. Designed for complex forecasting situations that require expertise from a variety of fields and backgrounds, EFTE is most effective when the social complexity (personality conflicts, conflicting goals, etc.) is low. The process provides protection from group pressures by allowing anonymous estimates (and anonymous questions during the Talk phase) while facilitating a rich, face-to-face discussion and sharing of information from different backgrounds.

In obtaining estimates for the three parameters S, A, and W, there are actually four estimation periods for each "round" of the EFTE (remember that the "A" parameter requires separate estimates for ACTION and for JOB). Thus, the EFTE procedure will be as follows:

Round 1
- **S** estimate.
- **A**-ACTION estimate.
- **A**-SECTOR estimate.
- **W** estimate.

Round 2
- S feedback, talk, estimate.
- **A**-ACTION feedback, talk, estimate.
- **A**-SECTOR feedback, talk, estimate.
- **W** feedback, talk, estimate.

Iterate as appropriate.

Each estimate performed in the EFTE procedure will have six components. Participants will be asked to make estimates for the years 1990 and 2000. For each year, participants will be asked to give three estimate values:

1> **LO** represents the lowest value the participant considers reasonable or likely.
2> **HI** is the highest value the participant considers reasonable or likely.
3> **BEST** is the participant's "best guess" estimate for that year.

The primary focus of the research will be the BEST value for the year 2000. However, the LO and HI estimates will provide information for sensitivity analysis. The inclusion of the 1990 values are thought to aid the participant in arriving at an estimate for the year 2000 by providing a stepping stone and will provide a basis for discussing advancement mechanisms in the Talk phases of the EFTE.

Table 2 is a sample of the questionnaire form to be used in the estmation procedure. Note that it allows two modes of response for each estimate. The participant may elect to provide numerical estimates for LO, BEST, and HI for each year. Alternatively, the respondent may elect to mark the scales provided. Note that this mode of response requires an answer ending with either "0" or "5". The free form answers will also be rounded to the nearest number ending with "0" or "5". (Previous EFTE surveys have found that participants responding on such 0 to 100 scales almost invariably respond with such answers.) In addition, this approach will simplify the accounting required for the feedback.

FEEDBACK Format

Graphics will be utilized extensively in the feedback format. We hope this will aid in the assimilation of information as well as speed the FEEDBACK process.

The graphic feedback is illustrated in **Table 3.** The format is based on the "buckets" established in the questionnaires corresponding to values ending in "0" and "5". For each question,

1> The buckets between a participant's LO and the HI estimates (inclusive) will be given a value of 1 point.
2> The bucket containing the participant's BEST response will be given an additional 2 points. Thus, for the question, each individual's scale will show some buckets with no points, a number of buckets with 1 point, and one bucket scored with 3 points.
3> The responses for all participants will be summed into a common scale to provide the overall feedback for the question.
4> The feedback sheet to be displayed to the EFTE participants will also show the median BEST answer.

See **Table** 3 for illustration.

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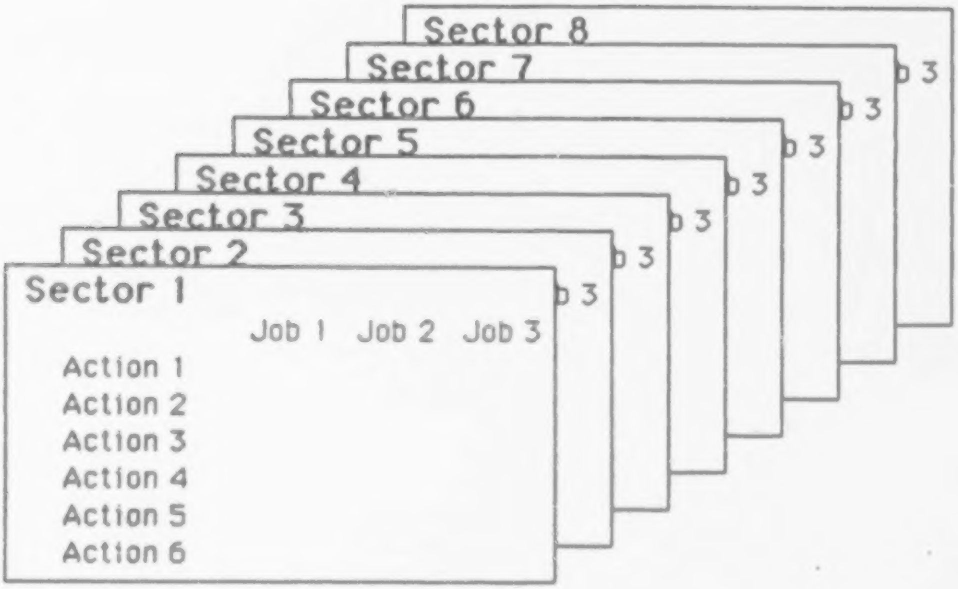
Figure 1



Equation 1

$$\mathrm{WORK}_{t,a,j,s} = (\mathrm{WORK}_{1980,a,j,s} \times W_{t,a,j}) \times (1 - [A_{t,a,s} \times (1 - S_{t,a})])$$

Table 1

Actions	Definitions	Activities	%M	%P	%S	Technologies
Information Intake	The acquisition and ingestion of existing information from outside the organization.	Reading	10	10	2	keyboards OCR voice input workstation computer library services AI/expert systems E-mail
		Incoming Mail	5	5	10	
		(Info Search)	5	5	5	
		(Meet/Travel)	40	20	5	
Processing	Reviewing, revising, analyzing, modeling, planning, scheduling, etc.	Proofing	1	5	3	HW/SW advances expert systems workstations
		Calculating	5	15	3	
		Scheduling	2	2	3	
Database Management	The storage, retrieval, and update of information within the organization.	Filing	2	5	5	mass storage software input technologies
		Paper Handling	1	2	3	
		(Info Search)	5	5	2	
		(Typing)	1	2	35	
Information Creation	Generation of "original information" in the form of memos, reports, speeches correspondence, etc.	Writing	15	15	3	input technologies AI workstations
		Dictating	2	1	3	
		(Typing)	1	2	35	
Information Dissemination	"One-way" or "broadcast" communication (speeches, instructions, reports, *etc.*).	Copying	1	3	5	output/display technologies telecomm technologies local/wide-area networks work stations
		(Telephone)	10	10	10	
		(Meet/Travel)	40	20	5	
Interactive Communication	"Two-way" exchange of information in "real time" (meetings, conversations).	(Telephone)	10	10	10	telecomm technologies local/wide-area networks teleconferencing
		(Meet/Travel)	40	20	5	

Table 2

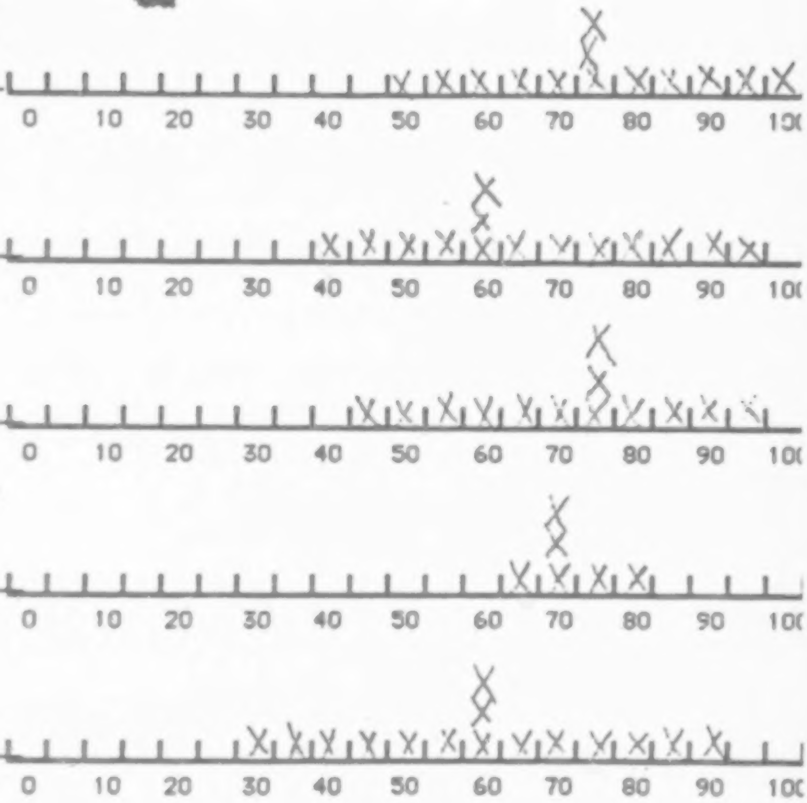
Actions			Numeric Response			Graphic Response										
			Low	Best	High	0	10	20	30	40	50	60	70	80	90	100
Information Intake	Manager	1990														
		2000														
	Professional	1990														
		2000														
	Secretary	1990														
		2000														
Processing	Manager	1990														
		2000														
	Professional	1990														
		2000														
	Secretary	1990														
		2000														
Database Management	Manager	1990														
		2000														
	Professional	1990														
		2000														
	Secretary	1990														
		2000														
Information Creation	Manager	1990														
		2000														
	Professional	1990														
		2000														
	Secretary	1990														
		2000														
Information Dissemination	Manager	1990														
		2000														
	Professional	1990														
		2000														
	Secretary	1990														
		2000														
Interactive Communication	Manager	1990														
		2000														
	Professional	1990														
		2000														
	Secretary	1990														
		2000														

Table 3

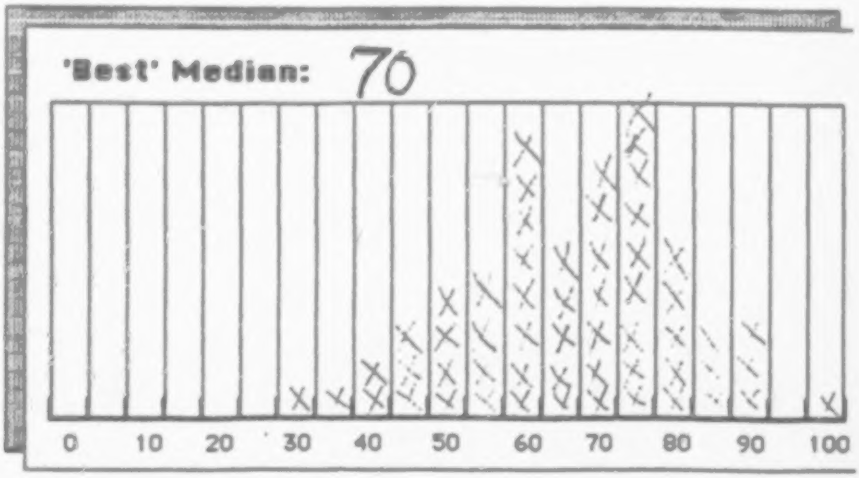
responses

"scoresheet"

Participant	**Low**	**Best**	**High**
Jones	50	75	100
Smith	40	60	95
Wilson	45	75	80
Brown	65	70	80
Williams	30	60	90



feedback posted for EFTE "talk" phase



Some Quick Reference Information for the EFTE

This sheet provides the basic definitions that underlie the office automation forecasting. The following 'idea sheets' are intended to jog your own thinking. They derive from the two resource papers augmented by ideas gathered from sundry sources.

We will focus on three factors. (To make the forecasting exercise viable we have had to preselect and structure these.)

Savings (S) -- the extent to which office automation technology will save time in accomplishing a fixed amount of work

Adoption (A) -- the extent to which potential users will adopt pertinent office automation technologies

Workload (W) -- the extent to which office automation technologies will alter the work amount demanded of a given JOB and ACTION, per unit of output.

These three factors fit together as follows:

$$\text{Work}_{t,a,j,s} = (\text{Work}_{1980,a,j,s} \times W_{t,a,j}) \times ((1-A_{t,a,s}) + AS_{t,a})$$

-- (workload at t) (fraction done using old tech x 1) (fraction done using new tech x rel t/unit work)

where t = time
a = information handling actions (6)
j = job types (3)
s = industrial sectors (8)

(This equation is an altered, but equivalent, form of that shown in the EFTE Strategy paper.)

In words, the process first adjusts the amount of work to be done at time t relative to that in 1980 by the fraction **W** (which may be greater or less than 1). It then partitions this into 2 parts. The first reflects that done using the old technology at a rate "1" -- reflecting the old productivity rate (so much time to produce a unit of work). The second part reflects the work done using new technology at a productivity rate **S** (relative to that using 1980 technology).

For instance, consider word processing for 1990. Suppose in our imaginary example that **W** is .6 (less text entry to be performed). Suppose **A** = .7 and **S** = .5. Then the 1990 work would = (.6) ((.3) + (.7)(.5)) = .45.

ADOPTION Idea Sheet

(a collection of suggestions)

Sales of Office Technology

* 1980 sales at perhaps $10 billion (reflecting about 12% of total non-farm equipment sales)

* Increasing at about 16% annually

* Projections are highly uncertain, ranging from a conservative $40 billion for 1995 to liberal estimates of $50 billion for the finance industry alone in 1995, or $58 billion to all industries in 1987

Unit Sales of Office Technology

* By 1990 there may be a microprocessor-based keyboard device for every white collar worker

* By 1995 there may be a personal computer/workstation for every knowledge worker

Capabilities of Office Technology Hardware

* Continue to increase

* Adoption decisions do not appear highly dependent on further hardware developments

Software and Systems Capabilities

* Linking devices into communication systems increases office automation attractiveness

* User-friendly software is especially important given concerns about training and implementation costs and barriers

* Specialized function needs of professionals may develop at different rates than generalized office function products.

Cost of Office Technology

* Continues to decline

* Price of the technology does not seem to be a major factor in the implementation decision

Implementation Issues

* Training and implementation costs appear to exceed costs of the technology

* Training and implementation costs will become more important as knowledge workers obtain the new equipment

The Second and Third Waves

* As communicating office automation systems enter, work will be restructured in fundamental ways. Organizational 'go/no go' decisions to adopt will meet more resistance than incremental device adoptions have.

* Managers and professionals (knowledge workers) will become major users of office automation.

* Office reorganization will spread over decades with large differences in how leaders and laggers perform office work.

Industrial Structure

* Competitive service industries in which office automation reflects in the quality of service provided customers will move rapidly, with the industry following the initiator promptly.

* Industries dominated by small firms will be more sensitive to costs (with less economy of scale for systems, software acquisition, and training) and slower to obtain information, hence will lag.

* Industries without significant competition will lag.

* Small offices are likely to lag because of cost sensitivities, lack of information, and diversity of work.

Labor

* High office wages, especially of knowledge workers, provide an incentive to automate.

* Labor savings alone do not account for decisions to adopt. Qualitative improvements in work attributable to office automation are proving difficult to measure.

* Labor savings become less of a factor as knowledge workers adopt the technologies and as office automation penetrates industries in which office work is less central.

* Labor resistance to office automation could increase as dislocation and unemployment result. This will be greater where unions are stronger.

* Shortage of skilled operators and trainers could slow adoption.

Behavioral Factors

* Inertial behavioral and organizational forces slow adoption in the short term.

* Office automation users like the technology.

Finance Industry As Leading Indicator

* Perhaps has reached the level of $8-10,000 of office automation equipment per employee (but this includes some automated teller, credit card confirmation, check handling, etc. automation activities too)

* Closing the gap with manufacturing's $25-30,000 capital investment per production employee

* The finance industry led in growth rate of capital investment per employee at 12.6% annually from 1960-1980.

* The percentage of finance industry capital investment in office and computing machines increased from 29% in 1975 to 41% in 1980.

Economic Influences

* Availability of capital in a firm does not relate closely to capital investment in a given year.

* Cost of capital (interest rates) does not relate closely to capital investment in a given year.

* Not unreasonable to anticipate at least 2 recessions by 1995; inflation may pick up if productivity gains lag.

Government Influences

* Restrictions to preserve jobs and/or provide retraining are possible.

* Incentives to enhance U.S. competitiveness are possible.

SAVINGS Idea Sheet

Note: New technology changes work by saving time in the performance of the same activities once done using an older technology. It may also lead to different work activities. **Savings** tries to include both sorts of changes by focusing on how certain information handling **Actions** will change. In addition, **Workload** is considered separately to take note of possible reorganization of the 'in-basket' work quantities.

Potential for Savings

* Managers and professionals waste time in doing record keeping, routine procurement of data, traveling unnecessarily, meeting and phoning unproductively, supervising minor tasks, and composing and disseminating routine documents.

Systems Have Special Potential

* One inventory system with a 43 branch network enables all branch searching, order entry, generation of shipping documents, updating of records, billing, inventory control, and management reports; it will soon provide planning information.

* Some observors of office automation have noted time savings and shrunken office staff.

* Managers' span of control can be increased, making some intermediate management jobs superfluous.

* Managerial support can shift from specialists performing functions in the manager's own area to information specialists who help the managers perform the functions themselves.

Evidence of Use by Knowledge Workers

* One study of 83 managers/professionals finds an average 12 hours/week of use. Of 101 important applications, 40% entail analysis, 16% information creation, and only 1% communication ('first wave automation' -- much interest by these knowledge workers in future communication capability).

* Another reports managers using spreadsheets for planning, budgeting, data manipulation; electronic communication to replace face to face meetings and handwritten memos; some word processing; electronic data transfer; graphics for simplified reporting.

* A pilot electronic mail system in one firm reduced managers' phone time as much as 1 hour/day. Net productivity gains were reported as 10-20% for managers; about half that for professionals.

Ways That Office Technology Can Save Information Handling

* Electronic processing can reduce time waiting for information.

* Decision Support Systems (DSS) could aid in obtaining information.

* Direct entry via OCR or voice recognition displaces keyboard entry.

* Electronic filing and integrated output (electronic

and/or produced directly) reduces paper handling (consider FAX; intelligent copiers; integrated voice, image, and data; photo typeset).

* Text processing is improved by automatic indexing, global editing, automatic formating, filing, cross reference automation, text-graphics integration, spelling correction, and keeping track of text revisions.

* Expert systems could take over routine knowledge worker decision making. These could also aid with information search.

* Collaboration is facilitated by communication ease and speed.

* Message systems reduce memo writing and phone calls. These can use automatic headers, transaction records, and automatic distribution.

* Electronic communication via LANs and external networks can reduce the need for meetings.

* Teleconferences can be more efficient than face to face meetings.

Problems Induced by Automation

* Managers relying extensively on automation may lose ability to manage people.

* Electronic communications with automated routing may increase the information load disproportionately to the value of the additional information.

WORKLOAD Idea Sheet

Nature of Work

* Worker performance will come under more scrutiny by customers, supervisors, and peers.

* Work will become more subjective and interactive.

* Expert systems and work stations change the nature and amount of work to be done by professionals such as computer specialists and engineers (e.g., through Computer Aided Software Engineering).

Blurring of Work Roles

* The duties of different workers will be less sharply differentiated: managers/professionals; managers/secretaries/clerks; professionals/technicians;

* For instance, managerial and professional workstations enable direct document creation, data base entry, and possibly dissemination. This reduces the requirements for clerical support.

Labor Reductions Are Amplified

* Work demands diminish for clericals, in turn reducing the need for managerial supervision.

* Direct access to information with decision support systems allows for fewer managerial levels. Fewer managers require less clerical support.

* A smaller organization simplifies communication. Fewer knowledge workers need to meet to coordinate activities; scheduling is simplified; fewer copies of documents are distributed and filed. Hence, support staff can be further reduced. The image of the "one man" insurance company is just barely infeasible.

Streamlined Organizational Structure and Process

* More continuity in work flows with fewer discrete linkages means more uniformity and enhanced management control. Less effort is required to manage the organization per unit of output.

* LANs and PBXs, with shared data bases, convert devices into information systems. These alter the nature of work flow (who processes what information; who receives what communications) and the nature of outputs (e.g., electronic messages replace some written documents).

* Some new forms of work will evolve in the restructured organization with its altered processes, consumer interfaces, and missions.

* Both horizontal and vertical integration are likely.

* Office work will fuse with other organizational activities. For instance, shared data allow for integrated inventory controls, shipping instructions, accounting, sales management, and planning.

'Last Word' Clarifications/Elaborations for the EFTE Forecast

This document responds to questions raised by our preliminary materials.

A working definition of office automation: The use of information technologies bearing on office work. Recognize that this continuing process traces back to the introduction of office machines (e.g., phones, adding machines). Current emphasis lies on microprocessor-based technologies. Information is the major currency. We would not exclude consideration of systems incorporating mainframe computers, nor of information work that stretches beyond traditional office functions into production control, sales, etc.

We will be estimating how new information technologies will alter certain work processes. We focus on sets of

3 prototypical **Jobs**
3 industrial **Sectors**
6 information handling **Actions.**

Actions seems the most conceptually troublesome. Please refer to Table 1 (in the EFTE Strategy). The set of 6 actions aims to include all major information work activities. It reflects compromise to accomodate a variety of activities performed by knowledge workers and support staff. Note the distinction drawn between 'Information Intake' and 'Information Creation.' We take an 'information system' perspective -- secretarial typing enters new information into the system and is, thus, classified as 'Information Creation'.

'Processing' emphasizes the intellectual manipulation of information. In contrast, 'Data Base Management' pertains to information movement and maintenance.

We know that other categorizations are reasonable (c.f., our own resource paper on the technologies). However, for the EFTE, it is critical that everyone use a consistent set of **Actions,** as defined in Table 1.

Still in Table 1, the 'Activities' do not map 1 to 1 on the Actions (e.g., 'Meet/Travel' may serve several Actions). The %'s tallied reflect literature estimates of how managers, professionals, and secretaries spend their work time. These sum to 100% by not double-counting activities that are listed under more than one Action -- namely those shown in ()'s.

Technologies do not map 1 to 1 on Actions in Table 1. Some of you have suggested additional points about pertinent technologies:

* Software critical to all Actions
* Cartridges becoming important for software distribution
* Advances in user interfaces will boost Info Intake & Dissemination, and Interactive Communication
* Voice-data integration will also affect such Actions
* Image processing as well as OCR bears on Info Intake
* System/device configuration choices (e.g.,'Info Centers' that access central data bases) affect several Actions.

Perhaps the most critical question is 'How does the forecast address changes in the quality and scope of work?' We recognize that office automation, especially second/third wave, promises more than labor saving. Indeed, various taxonomies of benefits of automation exist. We believe the framework we are using today offers a suitable way to get at major changes without too much detail.

Our basic premise is that labor productivity gains are an important feature of office automation. **(S)avings** taps this feature.

Increased productivity may lead to various outcomes --

* reduce labor, or
* expand services, or
* speed up processing, or
* dissipate time in 'coffee breaks',etc.

Our **(W)orkload** measure allows you to reflect reordering in work due to changing technologies. For instance, suppose you foresee professionals using telecommunications to reduce the time they spend to perform a set amount of 'Interactive Communications' and 'Information Dissemination' in half. Indicate Savings to 50% for these Actions. Suppose you see them doubling their analytical efforts as one use of this freed time. Indicate Workload up to 200% for 'Processing.' But, say you feel that new AI capabilities will help perform this increased Processing work. Indicate this by setting Savings at, say, 60% for 'Processing.'

In sum, use **S** and **W** to rebalance the work Actions to reflect use of changed technology.

(A)doption provides a separate estimate of the extent to which workers use these new capabilities. We can see how Adoption could vary by type of work involved (Action) and by industrial Sector. We ask you for separate estimates of Adoption by:

Action -- What % of (e.g., 'Info Intake') work will be done using new technologies (average over all Sectors) in Year (e.g., 2000)?

Sector -- What % of office work (average over all Actions) in Year (e.g., 2000) in (e.g., 'Manufacturing') will be done using new technologies?

The resulting Actions X Sectors Adoption matrix will reflect averaging of the extent of Adoption for the respective Action and Sector (not a cross-multiplication).

Georgia Tech Office Automation Research

thru: Technology Policy and Assessment Center

Studies

Computers & Communications: Office of the Future

Roessner/Rossini for NSF (Emerging Issues) - 1982

Impact of Office Automation on Office Workers (Bank/Insur)

Roessner et al. for DOL - 1984

Cost Justification of End-User Computing Systems

Sassone/Schwartz for IBM, GM, Trust Co. Bank - 1984

Forecast of Office Automation Technologies/ Effects on Work

Porter et al. for OTA - 1985

Applying AI to Delivery of Financial Services

Schwartz/Sassone for C&S Bank - 1985

Computer Use in R&D

Rossini/Porter for IRI - 1985

Information Processing Systems and Industrial Research Productivity

Roessner/Bean for Ctr for Innovation Management Studies - 1985

Adoption — Sectors

Round 1 [✓ 2] 3 4

Ag, Mine, Constr	L	B	H	1990	15	20	20	20	20	25	25	35	35	40	40	40	50	50
	L	B	H	2000	25	25	30	30	30	35	35	45	50	50	50	50	55	60
											⑷⓪ 40							
											35							
Manufacture	L	B	H	1990	20	30	30	30	30	30	30	40	45	50	50	50	55	60
	L	B	H	2000	30	35	35	35	40	40	50	60	60	60	60	65	75	75
											55							
											48							
Transp/Utilities	L	B	H	1990	30	30	35	35	35	[illegible]	[illegible]	45	50	50	55	60	[illegible]	[illegible]
	L	B	H	2000	35	40	40	50	50	[illegible]	[illegible]	60	60	70	70	75	[illegible]	75
											60							
											58							
Communications	L	B	H	1990	30	40	40	40	45	50	55	60	60	60	60	70	70	70
	L	B	H	2000	40	40	[illegible]	55	60	60	65	70	70	70	80	80	85	9
											68							
											40							
Wholesale/Ret'l	L	B	H	1990	20	25	25	30	35	35	40	40	40	40	50	50	55	60
	L	B	H	2000	30	35	40	45	45	50	50	60	60	60	60	65	70	70
											55							
											60							
Bank, Fin, Ins, RE	L	B	H	1990	35	40	45	50	55	55	60	60	60	65	70	70	75	80
	L	B	H	2000	45	50	50	60	65	65	70	75	80	80	50	80	90	90
											72							
											40							
Service	L	B	H	1990	20	20	30	30	35	40	40	40	45	50	50	55	65	70
	L	B	H	2000	30	35	35	40	45	55	55	60	60	60	60	60	70	[illegible]
											58							
											32							
Public	L	B	H	1990	20	20	25	30	30	30	30	35	35	35	35	40	40	60
	L	B	H	2000	30	35	35	40	40	40	40	45	45	50	50	60	70	75
											42							

*** Values shown are the "Best" estimates.
Circled values are the Median "Best" estimates.
Values in the boxes (the 4th value from each end) represent the 25th and 75th percentile "Best" estimates. In other words, half of the estimates fall inside and half outside these values.

Savings

Round
1 [✓ 2] 3 4

Info Intake	L	E	M	1990	20	40	65	70	70	75	80	80	80	80	80	80	85	90	90
	L	E	M	2000	30	30	40	50	50	55	60	65	70	70	70	70	70	75	75
Processing	L	E	M	1990	15	30	35	40	45	50	50	60	60	70	70	70	70	80	80
	L	E	M	2000	10	15	20	20	30	30	40	40	40	40	50	50	50	60	60
Database	L	E	M	1990	20	30	40	50	55	55	65	70	70	75	75	75	80	80	85
	L	E	M	2000	10	15	15	20	40	45	45	50	50	50	55	55	55	70	70
Info Creation	L	E	M	1990	45	45	50	65	70	70	75	75	75	75	75	80	80	80	85
	L	E	M	2000	15	20	20	50	50	50	50	50	60	65	65	65	70	70	[illegible]
Dissemination	L	E	M	1990	35	50	50	60	60	60	60	60	60	65	70	70	80	80	90
	L	E	M	2000	30	40	40	40	40	40	45	45	50	50	50	50	55	55	60
Interactive	L	E	M	1990	35	45	70	70	75	75	80	80	80	80	80	80	85	85	90
	L	E	M	2000	50	50	50	50	55	55	55	60	60	65	65	65	65	70	75

Adoption — Actions

Round
1 [✓ 2] 3 4

Info Intake	L	E	H	1990	15	20	20	25	25	30	30	35	35	35	40	40	50	50
	L	E	H	2000	20	25	30	30	40	40	40	45	50	50	50	60	60	60
Processing	L	E	H	1990	25	30	30	35	35	35	40	45	50	50	50	60	60	60
	L	E	H	2000	40	40	45	50	50	50	50	55	60	70	70	80	80	80
Database	L	E	H	1990	25	25	30	30	40	40	40	45	50	50	50	60	60	75
	L	E	H	2000	25	40	40	40	45	50	50	60	60	70	70	80	85	85
Info Creation	L	E	H	1990	20	25	30	35	40	40	40	40	45	45	50	50	60	60
	L	E	H	2000	25	30	40	40	45	45	50	60	60	60	60	75	80	80
Dissemination	L	E	H	1990	35	35	35	40	40	40	40	40	45	45	50	50	55	60
	L	E	H	2000	35	40	45	50	50	50	60	60	60	60	60	65	70	70
Interactive	L	E	H	1990	20	25	25	25	30	30	30	40	40	40	40	40	50	50
	L	E	H	2000	25	30	30	40	40	45	50	50	55	60	60	60	70	80

Workload

Round
1 [✓ 2] 3 4
FEEDBACK

Shown are the "Best" estimates

									↓				(50th %ile)			↓			
Info Intake	mgr	L	E	H	1990	80	120	120	120	120	130	140	140	140	140	150	160	200	200
		L	E	H	2000	140	140	140	140	160	160	180	180	200	200	200	250	300	300
	pro	L	E	H	1990	80	120	140	140	140	150	150	160	160	160	160	160	200	250
		L	E	H	2000	140	160	160	175	180	180	180	180	200	200	200	200	300	300
	sec	L	E	H	1990	60	70	90	90	100	100	120	120	120	120	140	140	140	140
		L	E	H	2000	60	75	80	100	100	120	120	130	140	140	140	140	180	200
Processing	mgr	L	E	H	1990	60	100	120	120	120	130	140	140	140	160	160	180	200	200
		L	E	H	2000	120	120	140	140	140	150	180		200	200	200	250	250	250
	pro	L	E	H	1990	60	90	160	160	160	175	180	180	180	180	180	200	200	200
		L	E	H	2000	90	100		250	200	200	200	250	200	250	250		250	300
	sec	L	E	H	1990	40	100	100	100	100	120	120	120	120	120	140	140	180	200
		L	E	H	2000	90	100	100	120	120	125	140	140	140	140	160	160	200	200
Database	mgr	L	E	H	1990	60	80	90	100	100	120	120	120	120	130	140	140	180	200
		L	E	H	2000	80	100	100	140	140	140	160	160	180	180	200	250	250	300
	pro	L	E	H	1990	40	100	120	140	140	140	140	140	160	175	180	180	200	250
		L	E	H	2000	80	120		140	140	160	160	180	200	200	250		300	300
	sec	L	E	H	1990	40	80	100	100	100	120	120	120	120	120	140	140	140	160
		L	E	H	2000	60	90	120	120	125	140	140	140	140	160	160	160	160	180
Info Creation	mgr	L	E	H	1990	60	80	90	120	120	120	120		120	140	140	140	150	200
		L	E	H	2000	60	90	130	140	140	140	160	160	160	180	180	200	200	250
	pro	L	E	H	1990	60	100	120	120	120	130	140	140	140	150	160	160	200	400
		L	E	H	2000	120	140	150	160	160	160	180	180	180	200	200	200	250	400
	sec	L	E	H	1990	40	70	70	80	80	90	100	100	100	100	100	100	100	110
		L	E	H	2000	50	50	60	60	80	90	100	100	100	120	120	120	150	180
Disseminate	mgr	L	E	H	1990	90	100	100	100	100	120	120	120	120	140	140	140	160	160
		L	E	H	2000	90	100	100	100	120	120	120	130	140	140	140	160	180	180
	pro	L	E	H	1990	80	90	100	100	100	120	120	130	140	140	140	140	100	160
		L	E	H	2000	60	80	100	100	100	120	140	140	160	160	180	180	180	200
	sec	L	E	H	1990	40	50	70	80	80	90	90	90	90	90	100	100	120	180
		L	E	H	2000	40	50	60	60	70	75	80	80	90	90	100	120	140	200
Interactive	mgr	L	E	H	1990	80	90	100	100	100	100	110	120	120	120	130	140	100	250
		L	E	H	2000	80	100	100	120	120	140	140	140	160	160	160	180	200	400
	pro	L	E	H	1990	60	80	100	150	120	110	120	120	120	120	140	140	150	160
		L	E	H	2000	70	100	120	120	120	120	130	140	140	160	180	180	200	250
	sec	L	E	H	1990	50	70	90	90	90	90	90		90	100	100	100	100	250
		L	E	H	2000	60	70	70	70	70	80	80	80	90	100	120	120	140	300

Georgia Institute of Technology
Atlanta, Georgia 30332

Office of Interdisciplinary Programs

TO: EFTE Participants
FROM: Alan Porter
RE: Final Round Estimates

Dec 6, 1984

Please excuse the delay in getting this material to you, but we have gone over all aspects with care. I think we are now in position to produce a good forecast of how changing office technologies are likely to alter office work. The group has invested considerable energy into understanding and refining the concepts. We appreciate that effort and your cooperative spirit. We are optimistic that two major changes will help us do the job. First, the fundamental 'equation' has been simplified and directed at 'actual' likely developments rather than mixing in 'maximum' effects. Second, definitions and assumptions have been clarified.

Enclosed are

* Round 3 instructions and forms
* Background discussion of changes made (appended for those who may wish to track how we got to the new formulation).

Round 2 results have been compiled. They are neither as random as some feared, nor as sharp as desired. However, we choose not to enclose these results. The reformulation means that Round 3 is distinct from Round 2. We do not want to confuse the respective estimations. (We will gladly send the Round 2 results later if you want them.)

A major source of confusion in the workshop was what to assume about the degree of **Adoption** in making workload and savings estimates. Another difficulty arose in dealing with 'best available' technology.

We believe the resolution of these uncertainties lies in estimating **actual anticipated** levels of workload and savings directly. That is, we ask you to formulate an image of the likely usage pattern of office technologies for 1990 and 2000. Given those patterns (a mix of 'old and new' technologies), estimate how much more quickly a unit of office work will be performed compared to how it was done in 1980. Then estimate how workload will shift due to this actual pattern of office technologies in use. **Adoption becomes** implicit in the definitions of savings and workload; it is no longer separately estimated. In equation form:

$$W(1990 \text{ or } 2000)/W(1980) = \mathbf{ws}$$

The terms are ratios to actual 1980 practice, with W representing work for some Action/Job/Sector unit. The instructions that follow give operational definitions of **w** and **s**.

Please send your responses to arrive by Dec 17. If that is not possible, could you call me (404-894-2330)? We deeply appreciate your help, and anticipate our next correspondence will be to share our draft final report.

Instructions for Round 3

We ask you to go through 5 steps. (Some good news -- the number of estimates is reduced!)

STEP 1. Consider the revised Table 1. As a general observation, we definitely agree that new office technology is blurring the distinctions among the ACTION categories. The present categories offer a somewhat arbitrary common ground. Many concerns should be cleared up by focusing on anticipated actual patterns of use of technology. In considering Interactive Communications, for instance, we cannot assume that everyone will be on local area networks or the equivalent.

The order ofthe ACTIONS has been changed to align better with an 'Input, Processing, Output' notion of information handling. The definitions of the ACTIONS have been elaborated (Table 1). Some specific observations appear in the Appendix.

We would like to compile your perceptions of which technologies will affect each of the info ACTIONS. **Please so indicate in Table 1, then proceed to Step 2.**

STEP 2. Before estimating **s** and **w**, let us clarify certain assumptions. We consider only 3 protypical JOBS: middle managers, professionals, and general office secretaries. We are not addressing the jobs that fall in between these. However, the work performed by each is free to evolve as office technology develops.

Our focus is on **doing office work.** For instance, engineers doing computer-aided design of an automobile part are excluded. They will likely make use of information technology not limited to the office technologies we consider.

All estimates are to reflect changes relative to actual practice in 1980.

Use the following definition in estimating **s:**

s = the % of time it will take the typical worker to perform a unit of an Info ACTION in year 1990/2000 compared to the time it actually took in 1980.

s thus reflects the average effect of actual office practices in 1990/2000. It asks how the mix of technologies in use will save time (across the 3 office job types and all sectors).

Recall that **savings** is specified as the relative time an ACTION will take, not the "time saved" from 1980 practice (probably a poor choice of terms). For instance, if you anticipate that a unit of Info Intake can be done in one-third the time in 2000 that it took in 1980, then **s** = 33%.

Please complete the savings estimation form now.

STEP 3. workload is defined as:

w = the amount of the given type of office work that will be performed in the year 1990/2000 relative to the amount performed in 1980, per unit organizational output (final products or services).

w reflects the change in the 'in-basket' amount of work to be done, taking into account new potentials and expectations, given the actual extent of implementation of office technologies. For instance, if you foresee the total pool of managers (not some single manager) doing 2 times the amount of Info Intake in 2000, per unit of organizational output, as they did in 1980, then w = 200%.

Please now estimate workload on the enclosed form.

STEP 4. By moving to 'actual' w and s estimates, we have lost the SECTOR-specific Adoption estimates. We considered asking for w and s by Sector, but decided it was just too complex. In reviewing the Round 2 Adoption estimates, we were pleased to see that they showed a consistent ordering. Median best estimates for 1990 and 2000 (as well as 25th and 75th percentile values) gave the same sector ordering.

Please review the enclosed Sector Adoption form and suggest any desirable changes.

STEP 5. So far, the EFTE procedure has forced you to fit your perceptions of likely future developments into our 'boxes.' Discussion at the workshop strongly suggested that you hold much richer images of future office work profiles. Stopping short of asking you to draw full scenarios of the future office, we ask your impressions of how the 3 focal jobs will evolve. In your own words, could you depict how the middle manager, office professional, and general office secretary of today will have evolved in the year 2000? (If you wish, you might respond in terms of the mix of activities associated with each job in 2000 -- see Table 1.)

Please sketch your image of the activities of the 3 jobs in 2000 on the form provided. Then mail all your responses back. THANKS!!

Table 1 (rvsd)

Actions	Definitions	Activities				Technologies PLEASE LIST TECHNOLOGIES LIKELY TO EXERT A MAJOR INFLUENCE ON EACH ACTION:	
			%M	%P	%S	BY 1990:	BY 2000 (not by 1990):
Information Intake	The acquisition and ingestion of existing information from outside the organization into the human's head; Includes also: search outside the job-holder's work information system, screening, reading, listening	Reading	10	10	2		
		Incoming Mail	5	5	10		
		(Info Search)	5	5	5		
		(Meet/Travel)	40	20	5		
Information ~~Creation~~ PRODUCTION (AND TRANSFORMATION)	Generation of ~~"[illegible]~~ information" in the form of memos, reports, speeches correspondence, etc. Includes also the entry of information into a technological system by the job-holder.	Writing	15	15	3		
		Dictating	2	1	3		
		(Typing)	1	2	33		
Database Management	The storage, retrieval, and update of information within the organization.	Filing	2	5	5		
		Paper Handling	1	2	3		
		(Info Search)	5	5	2		
		(Typing)	1	2	33		
Processing	Reviewing, revising, analyzing, modeling, planning, scheduling, etc. Includes also deciding, selecting (e.g., which models to use). Includes both routine (rule-driven) and non-routine info processing, with the former more amenable to automation.	Proofing	1	5	3		
		Calculating	5	15	3		
		Scheduling	2	2	3		
Information Dissemination	"One-way" or "broadcast" communication (speeches, instructions, reports, *etc.*). Includes also letters	Copying	1	3	5		
		(Telephone)	10	10	10		
		(Meet/Travel)	40	20	5		
Interactive Communication	"Two-way" exchange of information ~~[illegible]~~ (meetings, conversations). Distinct from Dissemination in terms of the intent of quick feedback.	(Telephone)	10	10	10		
		(Meet/Travel)	40	20	5		

CANDIDATE "OFFICE" TECHNOLOGIES (Please use the letter codes in making entries above. Do not report items already listed for 1990 in the 2000 column. Some have found it easier to take each technology and decide which ACTIONS it could affect, rather than vice versa.)

A. Image Processing
B. Optical Character Recognition
C. Touch Input (e.g., mouse, touch-sensitive screen)
D. Voice Recognition
E. Word Processors
F. Microcomputers
G. Distributed Processing
H. Distributed Data Bases
I. Removable Hard Magnetic Disks
J. Optical Disks
K. Laser Printers
L. Voice Synthesis
M. Facsimile Transmission
N. Baseband Local Area Networks
O. Broadband Local Area Networks
P. Voice--Data Private Branch Exchange (PBX)
Q. Wide Area Networks
R. Teleconferencing
S. Communications Software (e.g., Electronic Mail)
T. Data base/library Search Services
U. User-friendly Operating Environments (computer-aided training)
V. Integrated Software Packages
W. Decision Support Systems
X. Management Information Systems
Y. Expert Systems
Z. Artificial Intelligence

Savings

Round

1 2 [✓ 3] 4

Info Intake															
	L	E	M	2000	0	10	20	30	40	50	60	70	80	90	100
INFO PRODUCTION (and TRANSFORMATION)	L	E	M	1990											
	L	E	M	2000	0	10	20	30	40	50	60	70	80	90	100
Database	L	E	M	1990											
	L	E	M	2000	0	10	20	30	40	50	60	70	80	90	100
Processing	L	E	M	1990											
	L	E	M	2000	0	10	20	30	40	50	60	70	80	90	100
Dissemination	L	E	M	1990											
	L	E	M	2000	0	10	20	30	40	50	60	70	80	90	100
Interactive	L	E	M	1990											
	L	E	M	2000	0	10	20	30	40	50	60	70	80	90	100

Workload

Round
1 2 [✓ 3] 4

						0	20	40	60	80	100	120	140	160	180	200	250	300	400	500	∞
Info Intake	mgr	L	E	M	1990																
		L	E	M	2000																
	pro	L	E	M	1990																
		L	E	M	2000																
	sec	L	E	M	1990																
		L	E	M	2000																
INFO PRODUCTION (and TRANSFORMATION)	mgr	L	E	M	1990																
		L	E	M	2000																
	pro	L	E	M	1990																
		L	E	M	2000																
	sec	L	E	M	1990																
		L	E	M	2000																
Database	mgr	L	E	M	1990																
		L	E	M	2000																
	pro	L	E	M	1990																
		L	E	M	2000																
	sec	L	E	M	1990																
		L	E	M	2000																
Processing	mgr	L	E	M	1990																
		L	E	M	2000																
	pro	L	E	M	1990																
		L	E	M	2000																
	sec	L	E	M	1990																
		L	E	M	2000																
Disseminate	mgr	L	E	M	1990																
		L	E	M	2000																
	pro	L	E	M	1990																
		L	E	M	2000																
	sec	L	E	M	1990																
		L	E	M	2000																
Interactive	mgr	L	E	M	1990																
		L	E	M	2000																
	pro	L	E	M	1990																
		L	E	M	2000																
	sec	L	E	M	1990																

Sector Differences in Adoption of Office Technologies

The ordering from leading to lagging sectors in adoption of new office technologies based on Round 2 responses is

1. Banking, Finance, Insurance, Real Estate
2. Communications
3. Transportation, Utilities
4. Service
5. Wholesale and Retail Trade
6. Manufacturing
7. Public Administration
8. Agriculture, Mining, Construction.

Would you suggest any changes in this ordering? If so, why?

Please describe your image of the activities of the 3 prototype jobs as they will have evolved in the year 2000. Refer to the activities denoted for the jobs in 1980 in Table 1. (Use additional sheets as you wish.)

Middle Manager

Professional

General Office Secretary

APPENDIX: Background Discussion

(NOTE: This discussion of the reformulation of the estimation approach is not required to perform the requested estimations. This is optional reading.)

Actions

The following points are elaborations of Table 1. They reflect comments at the workshop and our own thoughts on the ACTIONS.

Info Intake -- Includes both passive receipt of info (incoming mail) and active search. New technology may aid in searching libraries and external databases (not your own), possibly also in screening info.

Information Production (and Transformation) -- The retitling is intended to get rid of the 'creationism' difficulties. From a system perspective, we can include both a manager writing a report and a secretary typing it in this category. We differentiate Info Production from Info Intake. Info Production entails entry into a system; Info Intake, entry into a person. Note that technology may divert some of this work onto the customer (direct entry of own data).

Database Management -- Reasonable to assume that the volume of material in databases will increase but that the speed of access will also. The new technologies may divert some of this work to customers (perform their own system inquiries, etc.)

Processing -- Includes both the structured 'mechanical' and the unstructured 'human decision-making' activities.

Dissemination -- Wide-scale use of new technologies could generate Savings in need for instructions, automatic addressing, etc.

Interactive Communication -- Does not necessarily have to take place in real time. Again, technologies are blurring the distinction from Dissemination. Technologies can generate Savings here by reducing travel time, telephone tag, displacing some in-person meetings, etc.

The Equation, Old and New

Recall the original equation, rewritten to show the amount of work in the year 1990/2000 (for some given Action/Job/Sector unit) relative to actual practice in 1980:

$$W(1990/2000)/W(1980) = \mathbf{w}(1-A) + \mathbf{w}(AS)$$

The first term reflects work that will be done using base period (actual practice 1980) technology. The second represents work done using new office technology.

At the start of our meeting, the group agreed that the **w** component of the first term should be set equal to 1. The reasoning was that we were considering **w** as the change in the amount of work that would be done occasioned by the enhanced technology. Since the enhanced technology only appears in ther second term, **w** should only appear there.

On reflection, that does not seem sound. We cannot reasonably assume that the workload of those not using 'best available' technology remains unchanged by new office practices adopted by others. Grave uncertainties are caused by mutual dependencies among **w,s,** and **Adoption.** (Refer to the definition and discussion of Adoption in the earlier documents, especially 'Some Quick Reference Information' and 'Last Word Clarifications/Elaborations' for the EFTE.). Assuming 100% adoption of best available technology in figuring **w** and **s** is not workable. The argument that the adoption factor takes care of actual implementation fails because of likely non-linearities in the relationship between **s** and **a**, as defined. For instance, consider Interactive Communication. If we estimate savings (also workload) based on everyone being on local and wide area networks, the savings could be very high. The equation, of course, includes the adoption term as a multiplier of savings. That can compensate, but only to a 'linear' degree. In this instance, it seems clear that the savings will increase dramatically, in a non-linear fashion, as adoption becomes widespread. It is for these reasons that we shift to the revised equation (relative work = **ws**).

We should point out that in no case are we considering overall industry output changes within the **w** factor. Changes in industry output could be factored in at a later point to estimate employment impacts. We are not doing that. Workload is intended to reflect changes in the amount of office work undertaken for a set amount of industry (or whatever) output..In other words, technology provides greater potential, which may affect the amount of work undertaken in various categories.

Adoption/Savings

Adoption, as we had been considering it, entails both

1) the degree to which organizations acquire enhanced technology, and
2) the proportion of their office work done using enhanced technology.

Implicit estimation of these two factors together is difficult. This is made tougher by concerns about how much to weigh 'better than 1980 practice'technology vs. 'best commercially available' technology. The latter is also somewhat awkward to pin down.

One way around this problem is to reconceptualize Adoption as follows:

A = % of maximum savings capability actually expected to be achieved in the year 1990/2000.

Such an A factor becomes a suitable, linear multiplier for s in the equation. It is no longer 'market penetration.'

It is then a simple step to combine the adoption factor implicitly into the savings estimate. Then, instead of estimating maximum savings (associated with best available technology) and reducing this by an adoption factor in the equation, one simply applies a one-step estimation.

Workload

"Best"

	1990	2000
Dip. 2 - M	120 120 140 140 140 140 120 110 120 130 140 115 150 140 160 95	150 200 160 160 160 200 140 125 160 300 150 110 200 150 200 95
P	110 160 160 140 140 150 140 115 130 140 140 110 100 150 160 125	130 200 160 180 160 250 160 135 160 160 200 115 300 300 200 [illegible]
S	100 120 160 140 140 140 120 90 130 160 120 105 130 130 140 125	100 160 160 180 160 160 140 50 120 130 140 110 100 [illegible] 175
Dip. Ind - M	160 140 160 120 120 140 90 110 120 140 120 120 150 140 200 90	100 160 140 140 140 200 90 125 120 — 140 150 150 160 200 80
P	100 130 160 140 160 180 120 120 120 — 120 130 200 140 250 95	125 140 120 160 160 200 140 140 160 — 140 140 250 200 400 95
S	100 160 130 90 160 120 120 80 150 140 120 160 100 300 250 90	100 200 120 50 180 160 140 90 120 160 180 200 300 400 450 175
DG - M	120 160 140 140 180 140 160 110 120 130 120 110 90 160 100 90	180 180 160 160 200 200 130 125 160 300 140 120 300 200 180 120
P	150 130 140 140 180 140 140 120 120 130 120 130 90 160 180 60	200 140 160 160 200 200 160 135 160 400 160 150 300 200 200 [illegible]
S	110 160 140 160 180 120 120 100 120 150 120 150 50 300 200 80	140 200 160 150 200 140 140 100 140 250 160 170 300 400 250 95
Proc - M	170 160 160 140 140 160 120 110 120 140 120 130 150 200 200	180 180 180 180 140 200 140 120 180 200 160 140 210 300 200
P	150 160 160 140 160 160 140 120 130 250 120 140 150 250 300	250 200 180 180 160 200 160 150 180 250 180 150 200 300 250
S	110 150 160 90 90 120 120 110 130 160 120 160 160 160 200	150 200 200 80 80 140 140 90 140 180 150 170 100 200 200
Dissem - M	160 120 160 140 140 100 90 110 120 140 140 110 160 140 300	120 140 200 160 140 200 90 110 140 160 180 160 160 200 200
P	100 100 160 120 160 160 120 120 120 140 140 110 100 160 300	120 140 200 140 160 200 140 100 140 160 160 160 160 300 300
S	100 160 180 90 90 120 120 100 90 150 100 120 140 300 300	100 150 150 70 90 140 140 50 80 250 130 130 100 300 300
Intel - M	120 120 140 160 160 90 120 115 160 160 120 130 200 160 300	160 140 160 80 100 80 80 135 100 120 140 140 250 200 200
P	120 160 140 120 90 100 120 125 90 140 120 110 100 160 180	160 100 160 120 90 100 80 150 80 160 160 140 200 — 180
S	110 140 160 160 90 100 100 65 90 120 100 110 150 190 170	130 160 80 90 90 100 160 50 70 120 90 140 150 200 140

SAVINGS

1-Values for
(Schatz, Gates

	1990	2020
Lo		
Info In	80 80 60 70 75 60 70 70 85 70 70 70 60 60 30 40	30 65 50 50 80 40 60 60 85 35 55 50 40 5 25 20
Info Coord	70 40 40 60 85 70 40 65 75 60 60 50 50 50 10 50	10 20 30 45 80 40 25 10 60 45 50 40 25 20 10 40
DB	20 80 40 70 75 60 55 60 70 40 65 80 75 40 40 60	3 65 30 45 65 40 30 40 50 25 50 70 60 10 35 50
Proc	10 60 50 90 85 70 40 70 75 65 60 50 75 50 55 95	1 40 40 50 85 30 25 50 55 25 50 40 67 5 55 90
Dissem	70 65 50 10 75 90 45 70 55 40 70 80 90 60 45 50	30 35 90 55 60 30 60 40 35 20 55 70 40 30 40 30
Interaction	50 80 50 80 85 70 70 70 75 55 60 85 90 65 75 60	50 70 40 70 75 40 40 50 60 40 40 65 30 35 15 45
Mat		
Info In	90 90 70 80 90 80 90 80 90 90 95 75 80 80 75 75	60 80 65 65 85 60 85 75 90 75 70 60 60 20 30 50
Info Coord	85 65 60 75 90 80 65 75 85 70 75 60 70 60 70 70	40 40 50 60 85 65 45 70 75 60 60 50 40 10 40 50
DB	40 90 95 80 80 90 80 70 80 60 75 90 85 50 20 70	10 75 50 65 70 60 65 60 65 50 65 80 70 20 45 40
Proc	30 75 65 85 90 80 65 90 80 85 70 60 85 70 70 65	1 50 50 70 90 50 45 70 70 45 60 50 75 10 70 50
Dissem	85 75 65 85 80 90 75 75 65 70 80 90 60 75 60 60	60 50 60 70 65 50 45 60 45 35 70 80 50 50 50 40
Interact	90 90 75 90 40 95 90 80 85 80 70 90 60 80 25 70	70 50 65 20 80 65 70 65 70 50 55 85 50 50 25 55
Hi		
Info In	100 75 90 90 95 90 100 90 100 95 95 85 85 90 50 85	90 90 50 80 90 70 95 90 100 85 90 70 70 40 40 60
Info Coord	100 75 80 70 95 90 80 85 90 85 90 70 80 75 50 80	70 55 70 75 70 80 75 85 80 85 75 60 60 50 35 60
DB	60 75 70 70 85 70 90 90 90 80 95 100 100 75 65 90	30 90 65 90 75 40 80 75 75 70 90 90 85 35 60 60
Proc	50 85 90 75 95 90 75 90 90 95 95 80 100 80 90 75	10 65 70 85 95 70 60 95 75 80 75 70 100 85 90 60
Dissem	100 85 80 90 95 50 45 80 90 80 90 95 75 95 75 90	90 60 75 95 70 70 45 75 60 60 95 85 70 75 70 55
Interact	100 40 90 85 95 90 85 90 75 70 55 95 80 90 20 40	40 10 75 90 95 60 80 50 80 75 70 85 70 60 50 70

Workload

"Best"

	1990	2000
Inf. Q. - M	120 120 140 140 140 140 130 110 120 130 140 115 120 140 100 95	100 200 160 160 160 200 140 125 160 300 150 110 400 120
P	110 120 150 140 140 150 140 115 130 140 140 110 100 110 160 125	130 200 160 160 160 250 160 135 160 180 200 115 300 300
S	110 120 160 140 140 140 120 90 120 100 120 105 120 120 140 125	100 160 160 150 160 160 140 50 120 120 140 110 100 200
Inf. Ed. - M	100 140 100 120 120 140 90 110 120 140 170 120 150 120 200 90	100 160 120 140 140 200 90 125 120 — 140 150 150 160
P	100 120 160 140 160 150 170 120 120 — 120 130 200 140 250 95	100 140 120 160 160 200 140 140 160 — 140 140 250 200
S	100 160 120 90 120 120 120 90 100 140 120 160 100 300 200 100	100 200 100 50 150 160 140 90 100 150 150 200 50 [illegible]
Do - M	120 160 140 140 150 140 100 110 120 150 130 110 90 160 100 100	150 150 160 160 200 200 120 125 160 300 140 120 50 200
P	150 120 140 140 150 140 140 120 120 150 120 130 90 160 150 60	200 140 160 160 200 200 160 135 160 400 160 150 50 200
S	110 160 140 160 150 120 120 100 120 150 120 150 50 300 200 80	140 200 160 150 200 140 140 100 140 250 160 170 50 [illegible]
Pre - M	170 140 160 140 140 160 120 110 120 140 120 130 150 200 200	180 180 180 150 140 200 140 120 180 200 160 140 210 [illegible]
P	150 160 160 140 160 160 140 120 120 250 120 140 150 250 250	250 200 180 180 160 200 160 150 150 250 180 150 200 [illegible]
S	110 150 160 90 90 120 120 110 120 160 120 160 100 120 200	150 200 200 80 80 140 140 90 140 140 60 170 100 [illegible]
Dissem - M	100 120 160 140 140 140 90 110 120 140 140 110 100 140 300	120 140 200 160 140 200 90 110 140 100 140 120 100 [illegible]
P	100 120 150 120 160 150 100 120 120 140 140 110 100 110 300	120 140 200 140 160 200 140 100 140 100 140 140 100 [illegible]
S	100 160 150 90 70 120 120 100 90 150 100 120 110 200 300	100 150 150 70 70 140 140 50 80 220 140 120 150 [illegible]
Intl. - M	120 120 140 100 100 90 120 115 100 100 120 130 200 60 300	160 140 160 80 100 80 80 135 100 100 100 140 200 [illegible]
P	120 100 140 120 70 100 120 125 90 140 100 110 100 120 100	160 100 160 120 90 100 90 150 80 160 160 140 200 [illegible]
S	100 120 120 120 90 100 100 85 90 100 100 110 100 140 140	130 160 80 90 90 100 100 50 70 100 90 100 100 [illegible]

Georgia Tech EFTE Workshop Attendees

Dr. Tora Bikson
Rand Corpn.
1700 Main St.
Santa Monica, CA 90406
(213)393-0411

Dr. Vary Coates
U.S. Congress - OTA
Washington, D.C. 20510
(202)226-2245

Mr. Keith Cooley
Director, Environmental Systems
MSA
3445 Peachtree Rd.
Atlanta, GA 30326 (404)239-2208

Mr. James McIn~~n~~erney
Communication Products Division
IBM Corp.
P.O. Box 12195
Research Triangle Park, NC 27709
(919)543-0305

Ms. Lois Martin, Vice President
The First National Bank of St. Paul
FBF Information Services
St. Paul, MN 55101
(612)291-5444

Dr. Robert Mason, President
Metrics Research Corpn.
130 W. Wieuca - Suite 200
Atlanta, GA 30342
(404)255-1976

Mr. Jack Mileski
Digital Equipment Corp. - MK 2-2 B15
Continental Boulevard
Merrimack, NH 03054
(603)884-5365

Mr. Mark Mueller
AT & T Information Systems
307 Middletown-Lincroft Rd.
Room 3M307
Lincroft, NJ 07738
(201)576-3579

Dr. Vernell K. Munson
President, Knowledge Systems
P.O. Box 5743
Kingwood, TX 77325-5743
(713)360-2391

Mr. Keith Nelms
IED-EDL, GTRI
Georgia Inst. of Technology
Atlanta, GA 30332
(404)894-3830

Mr. Robert M. Peabody
Asst. V.P. and Director of Office
Automation
Mutual of Omaha
Mutual of Omaha Plaza
Omaha, NE 68175
(402)978-2576

Dr. Alan L. Porter
School of ISyE
Georgia Inst. of Technology
Atlanta, GA 30332
(404)894-2330

Dr. J. David Roessner
Social Sciences
D.M. Smith Building
Georgia Inst. of Technology
Atlanta, GA 30332
(404)894-3195

Dr. Fred Rossini
Social Sciences
D.M. Smith Bldg.
Georgia Inst. of Technology
Atlanta, GA 30332
(404)894-2375

Dr. Peter Sassone
College of Management
Georgia Inst. of Technology
Atlanta, GA 30332
(404)894-4912

Dr. Perry Schwartz
RAIL - Baker Bldg. GTRI
Georgia Inst. of Technology
Atlanta, GA 30332
(404)894-3662

Mr. Ralph E. Upton, Jr.
Director St. Augustine Technical Center
Collins at Del Monte Drive
St. Augustine, FL 32084
(904)824-4401

Mr. Robert Yellowlees, President
American Telesystems Corp.
Six Piedmont Ctr., Suite 608
Atlanta, GA 30305
(404)266-2500

An Assessment of Offshore Office Work

Christopher Astriab

Prepared for the
Office of Technology Assessment
Congress of the United States
Washington, DC 20510

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AN ASSESSMENT OF
OFFSHORE OFFICE WORK

Submitted by
Christopher P. Astriab
to the
U.S. Office of Technology Assessment
Contract # 533 - 0630
February 28, 1985

AN ASSESSMENT OF OFFSHORE OFFICE WORK

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INTRODUCTION

Electronic storage and retrieval of information is a technology deeply entrenched in a wide variety of commercial and industrial sectors. Indeed, the capability to electronically process data is often critical to the survival of various enterprises.

Because of tremendous growth in the adoption of this technology, due to the transformation of the United States economy from one based on industry to one based on information creation and dissemination, the labor force employed to process data has also expanded dramatically. A major portion of this labor force is dedicated solely to converting information from "hard" or paper form into digital form so it can be stored electronically. This entry phase of data processing is commonly referred to as "keypunching", "keyboarding" or "keying".

While the cost of electronic hardware and software continually declines, the cost of employing Americans for keying is rising both per employee and in the aggregate. High domestic labor costs have led to an international division of labor in data processing. Some U.S. firms have felt compelled to relocate their keypunch operations in offshore offices in order to take advantage of lower cost labor. Other labor intensive data processing activities such as coupon sorting have also been exported to other countries.

Keypunching data offshore can offer attractive economic benefits to those who avail themselves to it. Typists in Caribbean countries, for example, earn typical weekly wages that range from about $15 (U.S. equivalent) to approximately $60, while their counterparts in the U.S. may often earn as much as six times the latter figure per week. Even with transportation, communications and other costs accounted for, total expenses for keypunching data offshore may still not equal the cost of carrying out the process domestically.

The figures for workers in the Caribbean are cited because several data-entry facilities are presently operating in the region, and for a variety of reasons, their number is expected to increase. Not only are labor costs low, but the region is easily accessible due to its close proximity to the U.S. Shipping costs are therefore relatively low, and time-in-transit can be very short. Also, communications and other sectors of the infastructures in the region are reasonably well developed, literacy rates of most Caribbean populations are high, and favorable tax provisions for foreign investors exist. The Caribbean is only one region, however, in which offshore offices could proliferate.

Moving keypunch operations offshore is a sophisticated approach to dealing with high labor costs because of advanced technology that can sometimes be involved; "telematics" - the merger of computers with telecommunications - has enabled offshore offices to link up electronically with operating bases in the U.S., presenting new and interesting possibilities regarding the types of work that can be performed at remote sites.[1]

This mode of operation can be rather simple to implement. The tools and raw materials for this industry are light, relatively inexpensive, and easy to transport. Further, if full advantage is taken of telematics, distance and time become almost incidental factors when choosing sites at which to locate offshore offices.

This paper will describe various methods of operating offshore offices, outline factors which must be considered when deciding to establish such enterprises, and cite differing views regarding the phenomenon. The extent of present use of offshore offices and their future growth potential will be assessed, and mechanisms available to promote or impede their development will be discussed.

I. THE MECHANICS OF OFFSHORE DATA PROCESSING

HOW OFFSHORE OFFICES OPERATE

- Linkage Arrangements

There are three principal methods of linking offshore data-entry sites with data sources and end-users in the United States. All three use some combination of air shipment or electronic transmission to move data back and forth between sites.

The least sophisticated approach to linking offshore offices with the U.S. is to simply ship information by air in both directions. Typically, "hard" or paper documents, microfiche, magnetic tapes, cards or discs, or audio recordings are collected into large batches at one or more U.S. sites for packaging. In the case of paper documents some preliminary hand sorting may occur at this time, depending on the type of documentation. A major U.S. airline, for example, sorts ticket stubs according to station, flight number, and passenger class before shipping them abroad.

After documents are sorted and packed, they are shipped to the offshore site via regular air freight, or overnight courier services, if more rapid transit is preferred. Upon arrival at the host country airport, the packages are cleared through customs and delivered to the processing site by existing courier services or employees of the user firm. At the processing facility, they are distributed to keypunching staff. Each keyer has their own video display terminal which is typically linked to an on-site computer central processing unit. After the information on the documents is keyed into the computer the data is recorded on magnetic tapes, disks or cards. These are then shipped back to the U.S. where the data can be stored, electronically reconverted to hard documentation, or fed into a computer program for analysis, depending on the type of data involved and its end use.

The second method of linking sites involves air shipping documents from the domestic point of origin to the processing site and then electronically transmitting the digitized data back to its source or other end users. Typically, the data processing sites are linked via terrestrial telephone lines to satellite earth stations where large dish antennas are located. The utilization of this method is, of course, limited by the availability and proximity of earth stations, but the use of electronic communications is attractive to some firms because it permits shorter turn around times. Where satellite communications facilities are not available it may be possible to use submarine cable links to access the continental U.S. Theoretically, the reverse of this process (i.e., transmitting data to the offshore site and shipping hard documents back to the U.S.) could be utilized, but no specific instances of such use have been determined.

Finally, electronic data links may be used to transmit data in both directions. In this mode of operation documents in the U.S. are facsimiled and transmitted to the offshore site, keypunched, and then re-transmitted back to end-users. The facsimile process involves taking an electronic "picture" of a document which can be transmitted and reproduced at a remote site. Information that has already been digitized, but requires further processing or revision, may also be sent abroad by simply "playing back" data on magnetic media and transmitting it from the U.S. to the offshore site.

Two-way electronic links offer the shortest possible turnaround times, and may, in fact, be the only practical method of processing data offshore when the ability to deliver it to end users within a very short time frame is essential. For example, a major U.S. printing house presently exploring the feasibility of establishing data processing facilities offshore indicated that certain financial data it presently handles domestically must be processed and delivered to end users in as little as 15 hours.

o Types of Data Processing

The kinds of data processed offshore and the types of processing they require are many and varied. Documents sent abroad for processing typically include manuscripts; legal documents; insurance or medical records; statistical data; financial statements; coupons for food and other products; order or subscription forms; business documents such as ledgers, payrolls and the like; ticket stubs; mailing lists; contest or sweepstakes entry forms, or audio recordings to name a few. In most cases, the documents are produced in large volumes on a relatively continuous basis, and the need for their conversion to electronic form is essential to the end users.

Processing in many instances is limited to simply converting textual or tabular information on hard copy into digital form so it may be more readily reproduced, stored, manipulated or analyzed. One company, for example, keys in mailing lists and contestant entry forms, while another concentrates on keying textual and financial data for a Fortune 500 client base. A major U.S. airline keys in data from ticket stubs gathered from its operating bases throughout the country.

Processing may also involve reformatting documents or revising and correcting texts that have already been proofread or edited and digitized in the U.S. The printing firm noted previously, for instance, indicated that it may transmit to an offshore site "rough" copy that had already been keyed in the U.S. The offshore facility would key in the necessary revisions so that copy ready for typesetting could be obtained.[2] Another firm cited the need to reformat financial data at its offshore facility into standard forms for subsequent use in the U.S.[3]

o Examples of Offshore Offices

The following capsule descriptions exemplify the different types of offshore offices and the methods by whixh they operate.

o A California-based firm air-freights batches of paper copy to its keying facility in Singapore. From there, the keyed data is sent to its branch office in Australia via satellite. This allows the company to update the files of its Australian clients on a daily basis.

o A prominient Texas businessman has an arrangement with students at Tsinghua University in the People's Republic of China to key in numerical and narrative information from surveys. Magnetic tapes containing the information are then flown to the U.S. for analysis.

o In Limerick, Ireland, a major U.S. market research firm operates a service which keypunches magazine subscription information.

o In Port-au-Prince, Haiti, and Chihuahua, Mexico, other branches of the same firm sort product coupons and develop rebate lists.

o A major U.S. international airline collects ticket stubs from its operating bases throughout the United States and flies them to its keying facility in Barbados. There, information on passenger class, point of embarkation, and destinations, etc. is keyed by a staff of almost 300. The information, which provides the airline with a marketing and revenue database, is sent over private leased lines via satellite to its data processing office in the U.S. on a daily basis. The company transmits about 2.25 million characters to the U.S. every month. Information on data-entry personnel efficiency is transmitted back to Barbados for analysis by managerial staff. The airline is now soliciting contract work in order to make its keying operation into a profit center.

o A New Jersey-based company has entered into a joint venture with a Jamaican firm to key financial data for a approximately two dozen Fortune 500 clients. The data - about 50% textual and 50% tabular - is used for financial reports. The firm cited a document turnaround time of one to two weeks. It presently flies hard copy to the facility for keying, but anticipates using facsimile equipment in the U.S. to transmit information to Jamaica, and then return it to the U.S. via satellite. Approximately 60 people are employed by the firm. It expects to double its size sometime in 1985.

o A firm in Montego Bay, Jamaica keys in mailing lists for such companies as The Great American Sweepstakes and Publisher's Clearinghouse. The responses to mass mailings are flown to Jamaica and mailing lists on magnetic media are flown back to the U.S.

o A small, Philadelphia-based firm operates a joint venture data-entry service which employs about 20 people in Madras, India. The company concentrates on keying in past records, and disk-to-disk conversion of data for clients shifting from one kind of computer system to another. It had originally used a Kurzweil optical scanner which translates printed characters into digital form for storage on magnetic media. It found that use of the machine was not cost effective, and also encountered technical problems regarding the capability of the machine to read accurately. It gave the machine to a university and now uses data-entry workers exclusively to key in information.

FACTORS TO CONSIDER WHEN MOVING OFFSHORE

Reasons that American companies have cited for establishing offshore offices may be categorized into seven general areas:

1) growth in the information processing industry and an increase in the need to convert information from hard copy to digital form;
2) rising domestic labor costs and the availability of lower cost labor offshore;
3) the advent of technology that facilitates the efficient conduct of office work at remote sites;
4) the existence of suitable foreign infrastructures capable of supporting offshore office work;
5) the availability of measures which can be taken to insure the security of information in transit;
6) the general absence of regulatory impediments that might inhibit the exportation of office work, and/or restrict the flow of data across international borders; and
7) the existence of politically stable environments that are conducive to and supportive of the conduct of business outside the United States.

o The Information Market

In recent years the United States has witnessed the beginning of a transformation from an industrially-based to an information-based economy. As the director of one foreign government industrial development corporation put it:

> "In today's world, information resources have become abundant ... and more efficient as a result of the progress stimulated by the new electronic technology. It seems fairly clear, to me at least, that as the U.S. economy continues its transformation from industrial activities toward information creation and distribution, that the demands for information services will continue."[4]

Never before have we been so dependent upon our ability to create, store, retrieve, analyze and disseminate prodigious volumes of information at an increasingly faster pace. In assessing the magnitude of our need for information, the president of a U.S. firm presently engaged in offshore keypunching opined that "... the history of the world, which is in writing, is about to be put into electronic databases throughout the world."[5]

Not only is our appetite for information great; so to is our desire to satisfy that appetite evermore quickly. The need for rapid access to information helped to stimulate the creation of electronic data storage and retrieval systems. Their existence, in turn, has accelerated the speed at which information must be generated, and increased the volume of data we need to enter into computerized information systems.

In fact, the capability to generate information in large volumes and on a relatively continuous basis is essential for the operation of offshore date entry operations. In the absence of these factors, the viability of offshore operations would be questionable. Attracting workers would be difficult if work were sporadic, and cost efficiency could decline rapidly, thus defeating the purpose of establishing such operations in the first place.

In the view of firms questioned, the existence of a large user market for digitized information is readily apparent. An abundance of opportunities to service this market and the desire of firms to do so in the most cost effective manner possible is also very clear.

o Domestic and Foreign Labor

Because virtually all information we wish to digitize must be manually keyed into electronic data systems, the size of the labor force needed for keying has grown, and is expected to rise significantly over the next decade. The U.S. Department of Labor has predicted that clerical work will be the fastest growing occupation during the 1980's, estimating that 4.5 million new clerical jobs will be created, or one in every four new jobs in the U.S. during the coming decade.[6]

It is safe to assume that a large portion of these new workers will probably have to devote at least some of their time to data-entry.

In the recent past we have experienced a trend in the international division of labor in which labor intensive work has been moved to offshore locations where wages are often significantly lower than those in the U.S. This practice has allowed many American manufacturing firms to maintain their competitive in international markets. For the same reasons, the exportation of data-entry work - one of the most labor intensive phases of data processing - is now occurring.

The hourly wage rate for keyers in other countries may range from one-fourth to as little as one-fifteenth of rates paid to U.S. keyers.[7] One U.S. firm claimed it was paying its domestic keyers $9.50 per hour, whereas average hourly rates at its offshore facility in Barbados were approximately $2.10.[8] This represents a savings of 78% in labor costs alone. While companies use different methods of estimating their savings by moving offshore, those questioned indicated that it was costing them about 75% less offshore than it would in the U.S. to obtain a comparable level of labor output. Such savings are clearly a strong motivation for moving data-entry operations to low wage areas.

In addition to low wages, another motivating factor is the availability of highly literate labor pools abroad. All companies surveyed indicated that a high literacy rate was a primary consideration when choosing their offshore site. Further, literacy in English is strongly preferred to avoid the complications of crossing a language barrier, although language barriers may not be as critical a factor if keying is strictly limited to numerical data.

The availability of trained workers is yet another incentive to set up keying operations offshore. Because the bulk of the work done at data-entry sites involves typing (typically, anywhere from 60% to 90% of the employees of data-entry operations may be keyers), a pool of trained typists must be assembled. Companies located in Jamaica and Barbados said that this did not present any problems for them.[9]

They did not feel there was any apparent shortage of trained clerical workers, claiming they invariably had more job applicants than positions. Young women comprised about 99% of the staffs that were assembled. A representative of one firm said that the average age of its keyers was 26.[10] Most of them had at least a secondary school education, while many had completed at least some post-secondary training.

All companies indicated that typing tests were commonly used to screen potential employees, with good spelling, accuracy, and typing speed being the principal selection criteria. One firm pointed out that its job applicants frequently scored higher on spelling tests than did

Americans it had tested who had the achieved similar education levels.

Literate, trained workers are essential to achieving an ability to key in data with very high speed and accuracy - another major concern of data-entry firms. A keying rate of 10,000 keystrokes per hour was cited as an industry standard.[11] Higher rates may be achieved if conversion is limited to keying tabular data on a numerical ten-key pad, while rates may average somewhat lower if textual data is being keyed.

The ability to achieve high accuracy rates seems to be a direct result of employing low cost labor. In order to assure high standards of quality control, two or three keyers may be given the same information to key, on the theory that no two personnel will make the same error. After copy is "double-" or "triple-stroked", parity checks may be conducted to spot errors. The original copy is then referred to in order to correct those errors.[12]

It would obviously be more expensive to achieve quality control in this manner in the U.S. Using the hourly wage comparison cited earlier as an example, copy triple-stroked for one hour in the U.S. would cost $28.50, while the same task offshore would cost a mere $6.30. It bears repeating that this wage rate was for workers in Barbados, where rates are generally higher than those for most other developing countries.

The error rates achieved by some offshore operations may be remarkably low A representative of one firm claimed his operation concentrates on providing very high accuracy rates in the neighborhood of "... about 99.995% or higher, or about one error in 20,000 characters or less, and we have far exceeded those standards."[13]

One concern regarding the quality of offshore labor is the availability of local managerial personnel. Companies located in Jamaica and Barbados claimed that skilled managers were more difficult to obtain than clerk-typists, but that good managers could be found, at least in these countries, even though some diligent searching may be necessary.

One firm stated that in its experience, foreign management was generally poor, did not have a positive attitude towards management, and that management training programs and role models were seriously lacking. Accordingly, it was making a special effort to train its managers "correctly", and to provide them with the proper incentives to manage.[14] The firm's general manager also said he felt "lucky" because he had been able to hire a young woman who had graduated from college in the U.S. for a key supervisory position.

Another company confirmed to a degree the difficulty of obtaining skilled management. It claimed it had promoted nine of its supervisory personnel from within, indicating that internal development of management was possible, and sometimes necessary. It had also sent at least one of its employees to its U.S. office for additional training to become the comptroller for the offshore operation.[15]

Finally, the size of available offshore labor pools may be an important consideration, especially if proposed operations are large. This holds especially true if countries with small populations, such as many of those in the Caribbean, are under consideration as potential offshore office sites. Offshore offices in the Caribbean that have been identified presently employ as little as ten to as many as 1,200 personnel. At least one firm, which presently employes about 60 people in Jamaica, claimed it located there because it believed similar companies already established in Barbados were absorbing most of the available labor pool in that country. It pointed out that bidding for such labor "might get a little steep ... particularly for a start-up company."[16]

In sum, labor forces most apt to attract U.S. firms to establish data conversion facilities offshore are available. They can be hired at low cost; are highly literate; skilled or semi-skilled; possess skilled managers; and are generally of a size sufficient to support proposed operations. The degree to which these characteristics are present or absent is, in part, the degree to which the offshore data conversion industry is promoted or inhibited.

o Communications Technology

Advances in telecommunications, in particular the advent of satellite communications, have yielded capabilities ideally suited to the operation of offshore offices. Unlike manufacturing industries which face financial and physical limitations of transporting raw materials and products, the information industry may "ship" its raw materials and products thousands of miles in seconds when in electronic form.

To do this, access to international communications networks is, of course, necessary. Several methods of linking up with these networks are available. Before discussing them, however, it should be noted that one may gain such access by being ordinary subscriber to a telephone system, or by leasing dedicated telecommunication lines. Dedicated lines are reserved for the exclusive use of the party leasing them. There are important economic and technical differences between the two modes of access.

In the first mode, conventional two-wire telephone lines are used. Parties transmitting data on such lines are charged "usage-sensitive" rates according to how long they are "on-line", and the volume of data they send. For example, sending data to the U.S. from ____________________ would cost a subscriber $ . . per minute, and ¢ per kilobyte (i.e., per thousand characters) of data sent. The manner in which the data transmission is routed does not affect cost. Because costs do increase with distance, however, it would behoove an offshore office usingconventional phone lines to locate as near as possible to the U.S.[17]

Even so, it does not appear economical to use conventional lines to send data on a regular basis. Two-wire lines may not be cost effective due to their limited data handling capability. They can carry data transmissions at a maximum speed of only 1,200 bits per second - a transmission rate commonly referred to as 1,200 baud. Because eight "bits" of information equal one "byte" or character (e.g., 1, 2, A, B, etc.), this transmission speed is equal to 150 characters per second. Lines may be "conditioned" to carry transmissions at 2,400 baud using special equipment, but such lines are not always available.[18] Nevertheless, these rates are quite slow, particularly when large volumes of data are to be transmitted.

Four-wire lines may carry data at speeds up to 9,600 baud. The data-only network of AT & T handles 56,000 baud. A proposed Xerox system would transmit at 300,000 baud, while the Satellite Business System can handle 6.3 million baud.[19] Clearly, transmission could be reduced and efficiency increased if faster baud rates are used. In the final analysis, the cost for using standard phone lines could become prohibitive because of the amount of time needed to transmit data.

When conventional telephone lines are used, a subscriber may not know what specific linkage arrangements are employed to connect its offshore office with the U.S. Once data is transmitted from the office site, the route it follows depends on the options available and the discretion of the public and/or private entity operating the communications system. Transmissions are routed in view of the traffic demands and carrying capabilities of different routes. Transmissions may even be "packet-switched". That is, a message may be broken up, temporarily stored at different locations along routes to the U.S., and subsequently transmitted as traffic permits.

When dedicated lines are used, the situation is quite different. First, a flat fee is charged for the lines (usually on a monthly basis) regardless of how often they are used. A large data-entry firm in Barbados leases two dedicated lines which connect it to its U.S. headquarters via satellite for a flat, fixed fee of $7,500 each per month.[20]

Because leased lines are designed with the user's needs in mind (e.g., transmitting data to the United States at the fastest rate possible), they can be made capable of handling data transmissions at speeds higher than those used for conventional telephone lines. Four wires instead of two are typically used to increase data carrying capability so that a baud rate of 9,600 (or 1,200 characters per second) may be used. This is a significant increase over the speed at which conventional lines can transmit. If conventional lines were used, it would take eight times longer to send a given volume of data which would, in turn, drive up costs considerably.

Despite the benefits of leasing lines, some problems may be encountered. Costs for dedicated lines may be out of reach of smaller firms that could not generate sufficient traffic to justify leasing them. It is more or less assumed, however, that a firm planning to transmit data back to the U.S. on regular basis would lease its own line, since the use of conventional lines would not be cost effective.

Dedicated lines may be difficult to obtain in countries that do not have well developed phone systems. Quite simply, there may not be enough wires available to devote to the exclusive use of one subscriber, or communications authorities may hesitate to reserve lines for such use.[21]
No instances of such difficulties have been determined, however, presumably because the companies questioned were located in countries where ample communications capacity was available.

Regardless of whether an offshore office uses conventional or dedicated lines, the objective is to tap into international communications links: satellites and/or submarine cables. While the tendency towards use of satellites appears to predominate when establishing communications links with offshore offices, the use of international submarine cables cannot be discounted. The desire for greater security and reliability of data transmissions may prompt the use of redundant communications channels.

Technological considerations may also warrant the use of submarine cables for one or more links in a communications chain, particularly if distances between the U.S. and the offshore office are very great. Bridging long distances - between India and the U.S., for example - presents a situation in which the use of submarine cables is virtually mandatory.

Because communications satellites are located in an equatorial orbit some 21,000 miles above the earth, data transmitted through them must complete a journey of more than 40,000 miles from source to destination. This results in a short (about 1/2 of a second) but significant delay in data acquisition which must be compensated for electronically.

Since the satellites have a limited geographic coverage or "footprint", and cannot link up directly with each other in space, at least two satellites would be needed to link India with the U.S. An earth station located where it could "see" both satellites would also be necessary. The double satellite hop, however, would create an unacceptable delay in signal propogation which could "play havoc with computers", according to one telecommunications specialist.[22] Transmission over submarine cables also delays signal propogation, but to a considerably lesser extent. Therefore, if data were to be transmitted from remote sites such as India, a cable link from the U.S. to an earth station in Europe or North Africa would be recommended.

As previously described, users of conventional lines have no influence over the routes their transmissions may follow. Those wishing to secure private lines have several options, however. One option is to use microwave transceivers. Microwave transmission utilizes directional dish antennas at sending and receiving sites. It offers a degree of independence from wirelines and is generally more reliable because cables and numerous junction points are largely eliminated. In areas where weather conditions such as high winds or flooding may disrupt wireline service, microwave may be particularly attractive. Further, microwaves can handle 9,600 baud communications traffic.

Microwave communications are used extensively in the Caribbean. The longest international microwave system in the world stretches approximately 800 miles southward from the island of Tortola, near the U.S. Virgin Island of St. Thomas, to Trinidad. Repeater stations are located on 12 of the islands, which can be accessed via terrestrial or submarine cables, or troposheric scatter stations. It would also be possible, depending on location, for offshore offices to position a microwave antenna on-site that would enable them to tap in to the main microwave link. In turn, access could be made to one of several satellite earth stations situated on the islands, or to submarine cables terminating in the region.

In either case, using microwave links depends on the technical feasibility of establishing such links. Microwave signals travel "line-of-sight"; that is, signals coming from one antenna must be directly aimed at the receiving antenna. If the distance between antennas is great (usually about 25 miles), repeater stations must be installed to boost signal strength. Also, the path between microwave antennas cannot be obstructed by terrain or structures. The only way such obstructions may be circumvented is to use repeater stations to redirect signal paths. Nevertheless, dedicated on-site microwave paths, or wirelines to such paths may present viable options for offshore office communications links, and expand the number of geographic locations from which such offices could operate.

The use of light fibers is also a possibility. An eight millimeter diameter optic fiber can carry about 30,000 telephone calls - tha approximate capacity of a 20 centimeter copper cable. Light fibers are more resistant to conditions that cause disturbances in copper cable.[23] Unfortunatly, their use is not yet widespread.

A relatively new technology - cellular telephony, also offers the capability of providing data links between offshore offices and international communications terminals. This mode of operation offers high levels of reliability, ease of maintenance, and installation and maintenance costs significantly lower than those for conventional wireline systems.

Cellular telephony is a combination of ultra-high frequency radio transmission and advanced, sophisticated computer technology. It allows voice or data communications without the use of landlines, and is in essence a radio-telephone system. According to a representative of a U.S. cellular telephone company:

> "Cellular will provide nationwide data network capability and needed mobile and fixed services to all segments of an emerging nation. It may well assume the role of the wireline system replacement in smaller cities and in isolated rural areas. Cellular could be utilized to remove isolation, encourage dispersal of industry and increase the efficiency of projects located far from the urban concentrations of industry."[24]

Cellular telephony could play a significant role in bringing the information age to rural areas of the third world. It may allow third world countries to not only catch up, but perhaps also even surpass the phone networks that presently exist in developed countries.[25]

Its availability could present a wider range of options to U.S. firms looking for offshore office sites. In theory, the need to locate offices near major population centers and wireline communications networks could be eliminated. While other factors such as the education level of rural populations, land access to rural sites, and the desirability of rural dispersion of offshore offices must also be considered, cellular telephony, nonetheless, presents some interesting possibilities for offshore data processing.

Cellular technology is relatively new, and is presently in use in many major U.S. cities, primarily for mobile telephone service. Costa Rica, however, is slated to begin installation of a cellular system in early 1985, which will probably make it the first third world country to use cellular technology as an integral part of its telecommunications system.

While the establishment of communications links presents economic and technical problems for those operating offshore offices, communications authorities present problems of a different nature. In many developing countries communications networks are owned and operated by the government in order to generate public revenue. This monopolization may mean that all phone equipment and services must be purchased or leased from the government. This, of course, limits users' options with regard to the availability, type, and capabilities of the equipment they need to operate their facilities.

A U.S. firm in one Caribbean country complained that it had to lease its modem (i.e., the device that enables data to be transmitted over phone lines) from the government. This, it claimed, precluded it from bringing in more desireable equipment from the U.S., or purchasing it outright in the private sector.[26]

A country's reputation for providing hook-up and maintenance service also deserves consideration. Clearly, it would not be desireable to establish an offshore office where bureaucratic problems or lack of well-trained technical personnel caused significant delays in service, or impeded the timely and proper maintenance of the phone network.

In conclusion, many communications options are available to offshore offices. Well developed and reliable communications are essential to the development of offshore offices, especially if dependence on air transportation of data is to be reduced or virtually eliminated. While wireline systems may be used exclusively or in combination with other modes of communication to link offshore offices with the U.S., they may not always be readily available, appear to be somewhat more succeptible to disruption, are costly to install and maintain, and not always capable of data transmission at sufficiently high rates. Eliminating wireline links wherever possible may reduce installation and maintenance costs and increase reliability of communication. Further, microwave, fiber optics, or cellular telephony are better suited to data transmission by their inherent design. Regardless of which type of link or combination of links is used, communications cost, capabilities and reliability will remain key considerations when establishing offshore offices.

o Facilities, Transportation and Electrical Power

Regardless of how sophisticated communications systems may become, the availability of suitable facilities in which to house offshore offices, transportation to readily access them, and electricity to power them will always remain essential. The best communications may be worthless if employees cannot get to work, office buildings are unsound or not properly maintained, or electricity is unavailable or unreliable.

By and large it does not appear that U.S. firms have had serious difficulties in locating facilities in which to set up shop. Many foreign governments have developed industrial estates which rent or lease factory space at very low rates to foreign investors. In Jamaica, for example, the average monthly rent for such space is a mere $.42 per square foot, or about $5.00 (U.S.) per square foot per year (1982 figures).[27]

In contrast, the cost to lease one square foot of office space in Washington, D.C, averages about $_________. Renting equivalent amounts of space in Jamaica as opposed to

Washington, an investor may realize savings well in excess of 90%. While this is, of course, only one example, it is clear that the leasing of space at offshore sites can be considerably cheaper than in the U.S., and in some cases so much cheaper that leasing costs may be a minor consideration in the course of site selection.

Space may also be leased or purchased outright from the private sector, depending on foreign ownership restrictions imposed by governments. On occasion, it may be possible to expand existing locally-owned data processing facilities, if for example, a U.S. firm enters into a joint venture with an existing host country firm.

The quality of available facilities may vary considerably. Some office buildings may be on equal footing with those commonly found in the U.S., while others may be simple corrugated metal or concrete block shells adaptable to many uses. One U.S. firm adapted such a shell for its data conversion operation in St. Kitts-Nevis. Another spent approximately $1 million (U.S.) to upgrade an existing office building in Barbados. Its facility is regarded by the company, the Barbados government and the company's competitors as a "showcase operation" equal to the best facilities in the U.S.[28]

Employee comfort and ease of access must also be considered when designing and locating offices. Because most computer equipment requires temperature and humidity controlled environments in which to operate properly, the necessary equipment must be built in to facilities. At least two firms noted that employees complained about office air conditioning, claiming it was too cold for them to work comfortably. In such instances, separate, environmentally controlled rooms for computer central processing units may be needed.

On-site provision of meals for employees may also be necessary. One company, for example, found it had to provide low cost meals to its workers because they could not afford to regularly purchase meals at local restaurants.

Getting to work in developing countries may present some problems, depending on locale. Generally, it appears that office sites need to be located as near to employees as possible. The availability of reliable public transportation may be important, especially if distances between workers and work sites are too far to walk, and also because many workers may not have their own private transportation.

One firm felt compelled to obtain buses and establish its own routes because public buses were not reliable, and their schedules were incompatible with the firm's operating schedule.[29] Another claimed its employees had difficulty coming to work on more than one occasion because the public bus system was flooded out.[30] In any event, establishing offshore offices may require firms to compensate for inadequacies in host country transportation networks to the extent feasible.

Finally, the availability of international air transportation may be very important, particularly air, as opposed to electonic linkage arrangements are being used. Firms typically do not want to locate their offshore operations where direct flights to and from the U.S. are not readily available. This may effectively preclude some countries in the Caribbean from hosting such operations, particularly if electronic data links are not going to be used at all. The use of smaller inter-island air services may not be an attractive alternative, since they increase time-in-transit, raise shipping costs, are not always reliable, and may not even be capable of handling the volume of documents freighted to the region. In sum, it is important to have reliable transportation, and to keep links as short and direct as possible.

International air links seem to play a key role in influencing the geographic dispersion of offshore offices. One reason for their proliferation in the Caribbean is the fact that frequent, direct flights to many of the islands are available from major cites in the U.S. Another is that flights are of relatively short duration. Time in transit from New York to Barbados, for example, is a mere three hours. This is particularly attractive if time-sensitive documents are being dealt with. It also makes it easier to manage offshore facilities in the region, since American personnel may get to the sites relatively quickly if necessary.

Even if direct air links can be established between offshore offices and U.S. bases, however, movement of customer work can still be a problem. One firm claimed it had its document shipments "bumped" from air carriers during the tourist season because of the need to accomodate higher than normal loads of baggage.[31] If documents are time-sensitive, this cannot be easily tolerated. While such problems may be overcome by using overnight courier services, high shipment costs may be incurred.

Customs clearance in some countries may present a problem. One company in particular claimed it had repeatedly had difficulties getting shipments cleared, to the point where it felt that such problems "which may be so easily solved, and yet aren't, make one question how long one can continue in business under such circumstances."[32] Getting clearance on weekends, another firm claimed, may be next to impossible because customs officers may not be on duty.[33]

These problems, it was agreed, were not due to official customs policies, but seemed to be a matter of bureaucratic procedures and the attitudes of mid- and lower-level government officials.[34] It appears that while upper-level officials in developing countries are generally concerned about attracting and accomodating foreign investors, lower-level officials do not necessarily share these concerns. A representative of an American private, non-profit development promotion group suggested that this may be because of their generally unfavorable attitudes towards foreigners, and the perceived absence of any incentives to make any concessions to them.[35]

A final consideration regarding the infrastructures of foreign countries regards the availability and reliability of electricity to power environmental systems and the wide array of electronic equipment needed in today's office. Companies generally indicated, however, that concerns were not a major influence in their site selection process.

The use of on-site back-up electrical generators was advisable, since power grids in some countries experience sporadic brownouts (i.e., voltage drops below specified levels) or blackouts. One firm claimed it experiences about one brownout per month, and less frequent blackouts, both of which cause its computers to fail. It had installed its own generator, but then removed it because it apparently felt the problem was minor enough "to live with."[36]

Reliability of power is particularly important if information is being transmitted electronically, since computer failures due to power outages can disrupt transmissions. When stand-by generators are being used, it may also be necessary to install equipment to prevent electrical interference with computers, and to assure smooth transition from grid-supplied to generator-supplied electricity.[37]

The cost of electrical power also did not appear to be a major concern. While some firms felt costs were somewhat high, one pointed out that in Jamaica electrical rates were comparable to those on the eastern seaboard of the U.S.[38]

To summarize, infrastructures in many countries are not well developed, and lack the reliability and redundancy we take for granted in the U.S. Nevertheless, facilities may be far less costly abroad, and transportation and power inadequacies may frequently be dealt with at reasonable cost. Finally, the growth of foreign investment in less developed countries has, in many cases, spurred government efforts to enhance their infrastructures with a view toward attracting still more foreign capital, technology and expertise.

o Security of Data Shipments and Transmissions

With large amounts of data being transferred across international boundaries, security of data shipments and transmissions has been a concern. Firms questioned believe this is a rather minor problem however.

None cited any special measures that they take to insure the security of shipments. Yet the loss or interception of documents containing sensitive information could conceivably cause serious damage. This may be particularly true if information on stock offerings or other financial information is made known prior to the time a company wishes it released, or if private, intra-corporate communications are intercepted.

Interception of such shipments is not without its difficulties. One would probably have to have information about the nature and timing of shipments before planning attempts to abscond with them. It also seems unlikely that the effort would be made unless one was relatively certain that something worth the risk would be obtained. It may be safe to assume that value of intercepting data shipments has not yet been appreciated by the criminal element.

If particularly sensitive documents are being shipped, the use of air courier services may help to insure their safety. One such courier firm in the Caribbean region indicated that its shipments are accompanied and monitored by their personnel on a continuous basis.[39]

In any event, the companies shipping the information, as well as their clients, appear to be satisfied with its security. It is an implicit assumption among companies involved that information in transit will be secure.[40] If such guarantees could not be made, firms would probably not key their own data offshore, to say nothing of releasing it to contractors offering the service.

Intercepting electronic data transmissions is another matter altogether. While possible, it is rather difficult, requires technical knowledge, and, in the end, may not necessarily yield usable, understandable data.

Encryption can be used with relative ease to render data transmissions incoherent to anyone not possessing the equipment or the key required to break a code. Further, appropriate software would probably be needed to interpret information in a meaningful manner. The same applies to information on magnetic media that is being shipped across borders.

One company official pointed out that even if unscrambled transmissions were intercepted, "strings of characters may not mean anything to a person. You have to know what to do with them for them to be of any value."[41] Further, he stated that in his industry (airlines), much information is already shared, so the value of information transmitted may be negligible to another airline.

Nevertheless, wires can be tapped. and satellite transmissions can be picked up by parties other than the intended ones. Wiretapping can be detected fairly easily because the amplitude of an electronic signal is attenuated when a third party taps the line.[42] Identifying unintended recipients of satellite transmissions can be far more difficult. In either case, however, it would seem that a considerable amount of technical ingenuity would be required to not only intercept transmissions, but make them usable as well.

o Rules and Regulations

At the present time, regulations of any sort which bear directly on the establishment or operation of offshore data-entry services appear to be so few and/or minor that firms involved have expressed relatively little concern over them. Where pertinent regulations do exist, they usually stem from governments' concerns over the privacy of their citizens; national security; perceived loss of cultural independence; and concern that unrestricted data transfers could lead to loss of control over economic development and growth.[43] Accordingly, certain countries have erected various tariff and non-tariff barriers to regulate the content and operation of data banks, designate the methods and routes by which data can be transferred across international borders, and protect domestic producers of computer hardware, software and related items.

Many such laws were first promulgated by European countries such as Sweden, Denmark, France, Norway and West Germany. Many of these were drafted in response to concern over the privacy of citizens, and the flow of name-linked data across international borders. The United States has also adopted privacy laws, but does not restrict international flows of name-linked data.

Other countries, most notably Canada, Japan and Brazil have adopted laws with a view toward protecting their domestic data processing and computer industries. Restrictions of this sort tend to be found in countries which have relatively well developed information networks and markets, or have young domestic computer industries attempting to gain footholds in international markets.

Offshore data-entry operations have not been significantly affected by such laws because, quite simply, they have generally avoided establishing themselves in the counties that have enacted them. There are many other countries that have not yet addressed the issues surrounding data and its transfer which are more accomodating to the industry. Also, these countries tend to be less developed; have wage rates that are generally lower; and are in desperate need of the jobs, training, and capital that data-entry operations can provide. Further, they view industries such as data-entry as a basis for the development and advancement of computer and computer-related industries and capabilities.

Laws that generally do affect offshore keying operations regardless of where they locate are those concerning telecommunications. Such laws often mandate the use of public telephone and telegraph (PTT) networks and equipment. As a rule of thumb, these regulations are commonly found in developing countries, since the PTTs generate revenues for governments which characteristically operate on very slim budgets. Noted earlier, for example, was the fact that the use of the public telephone network and data transmission equipment was required in Jamaica. The U.S. company that complained about this, nevertheless, seemed to view it as more of an annoyance than a major obstacle. No other firms questioned expressed serious reservations about foreign telecommunications laws.

Foreign customs regulations also do not appear to have detrimental effects of any signifigance on data-entry operations. Many firms investing in developing countries are granted concessions including the privilege of importing raw materials, equipment and so forth duty free. The only notable complaints have to do with the difficulties in getting documents and other items cleared through customs in a timely manner. The delays that have been experienced do not seem to be a major problem, but some criticism, already mentioned, has been rather pointed. This is understandable since some firms are keying time-sensitive documents. It is unlikely, however, that customs problems would be allowed to assume such proportions that firms would start relocating to other countries. Threats to do so would undoubtedly spur authorities to take remedial actions to avoid losing sizable foreign investments.

U.S. telecommunications and customs regulations raise no obstacles to offshore keying. Telecommunications regulations that would impinge on the practice are non-existent. Customs laws govern the importation of documents and magnetic recordings, but tariffs are extremely low or not levied at all.

U.S. companies, particularly multinationals, keying their own business data (e.g., payroll, inventory, archives, etc.) may import these records duty free. These are classified under Schedule 8, Part 7 of the Tariff Schedules of the United States Annotated (TSUSA) (1981) as item 870.10 - "records, diagrams and other data with regard to any business ... operation conducted outside the United States, whether on paper, cards, photographs, blueprints, tapes or other media.[44]

Ordinarily, recorded magnetic tapes, cards or discs are classified under TSUSA Schedule 7, Part 2, Subpart G as item number 724.40 - "recordings on magnetic tape or any medium other than wire."[45] A duty of 9¢ per square foot of recording surface is specified. Thus, a duty of only $9.00 would be payable for a recording on a standard 2,400 foot reel of 1/2 inch computer tape (which contains 100 square feet of recording surface).

Even this negligible duty may not be imposed if the recordings originated in a country that is beneficiary to the Generalized System of Preferences. Such countries may export most or all of their goods to the U.S. duty free.

In any event, recorded media from data-entry operations are, by and large, regarded as returned U.S. goods and not subject to duties.[46] Specifically, they are listed under TSUSA Schedule B, Part 1 as item number 800.00 - "products of the United States when returned after having been exported, without having been advanced in value or improved in condition by any process of manufacture or other means while abroad."[47]

It is true that the physical characteristics of the media itself are not "advanced or improved" at keying operations, but it is argued by some that such media has an intangible good - information - added to it, and is, accordingly, increased in value. Sharp criticism in this regard has been voiced, particularly by U.S. labor representatives. As one union spokesman put it, "You may be importing a $10 tape with $50,000 worth of information on it."[48]

Such claims do not appear to be exaggerations in view of the prodigious volume of data that can be recorded on a given amount of magnetic media. If recorded at maximum density (data density is dependent on the type of recording equipment used), a 1/2 inch wide nine-track computer tape can hold 6,250 bytes or characters of data per linear inch. A 2,400 foot reel of tape holds up to 94 megabytes (i.e., 94 million characters). To put this in perspective, a commercial directory listing the names, addresses, telephone numbers, chief executives, Standard Industrial Classification numbers, sales levels and number of employees of the top 51,000 U.S. corporations comprises only about 30 million characters.[49] This equals approximately 1,500 pages of high-density text in very small print.

The president of a domestic data input company has argued that duties should be payable at least on the labor value added to processed tapes and disks. The directory mentioned above, for instance, probably took at least 3,000 person-hours to key at 10,000 keystrokes per hour. Using the $2.10 per hour wage for Barbados, it would cost roughly $6,300 to enter all of the data in the directory. His concern stems from the fact that his firm has lost "millions of dollars in contacts to offshore firms."[50]

Some labor representatives have even called for legislation to stem the outflow of keying jobs. As one asserted, "... to ship [such data] out of the country when we have over nine million people unemployed is absurd."[51]

In conclusion, data-entry firms presently operate in a very lenient regulatory environment. Developing host countries are not inclined to kill the proverbial "goose that laid the golden egg" by legislating against the data-entry industry. The benefits they obtain from it far outweigh any gains to be had by levying discriminatory taxes or imposing other restrictions. Undoubtedly, any moves in this direction would quickly cause firms to relocate to countries with more favorable business environments - of which there are many. Negative effects of U.S. laws are virtually non-existent. Vigorous debate over regulatory matters can be expected to continue, however, as labor unions and domestic firms pressure authorities to extend tariff treatment to international trade in data and data processing services.

o Political Stability in Foreign Countries

Perhaps the reason most frequently cited by U.S. firms in all sectors for not investing abroad is they must deal with too many unknowns. News of political upheavals, civil strife, expropriation of foreign investments, shaky economies, poor infrastructures, and inhospitable climates often combine to paint a picture of environments not conducive to the safe and undisrupted conduct of business.

Despite these problems, U.S. firms in increasing numbers are finding that the third world presents an abundance of business opportunities for those willing to assume the attendant risks. Also, many less developed countries recognize the importance of private sector development, and the advantages of permitting foreign investment to enhance such development. Not only does it expand their capital base, but it also provides new opportunities for host country owned businesses, brings in foreign technology and expertise, and provides training for their people, which in many cases is their most abundant resource.

Political stability of a foreign country and its policies regarding foreign, private investment are foremost concerns of U.S. businesses thinking about establishing offshore enterprises. A politically unstable environment may jeopardize: 1) the physical integrity or operability of offshore installations and the infrastructure supporting them; 2) the safety and/or availability of workers; 3) the ownership or control of offshore operations by U.S. or other foreign investors; 4) the free flow of goods, data or currency across international borders; 5) free convertibility of currency; and 6) the very existence of laws and regulations permitting the operation of businesses by foreigners, or allowing them to operate on favorable or attractive terms.

A representative of one U.S. company exploring the feasibility of establishing offshore keypunch operations posed the classic question: "Why should we put money into something over which we have no control?"[52] He continued, pointing out that some countries, while featuring characteristics generally supportive of data conversion operations, tended to have "very reactionary elections", and, therefore, were not considered likely sites for investment by his firm. The three countries he did cite as the final candidates for further investigation were all selected, he claimed, primarily because of their stability, followed by the high literacy of their people.

Governments of both the U.S. and many foreign countries have taken steps to encourage investment in the world's developing nations by helping firms to locate business opportunities, guarding them to some extent against the effects of adverse political developments, and providing business incentives attractive to U.S. firms. As a case in point, at least one American company claimed that U.S. and foreign government assistance was instrumental in his establishment of its data-entry operation in Jamaica.

Of significant importance to the firm was assistance provided by the Overseas Private Investment Corporation (OPIC). OPIC is a self-sustaining, profit-making federal agency whose mandate is to "mobilize and facilitate the participation of United States' private capital and skills in the economic and social development of less developed, friendly countries and areas." To do this, the agency provides political risk insurance, direct loans and loan guaranties, and other service, "all [of which] are designed to reduce the perceived stumbling blocks and risks associated with overseas investment."[53]

The president of the firm, which has a Fortune 500 client base, participated in an OPIC "investment mission" in 1983, which enabled him to meet with foreign government and local business officials, and conduct a preliminary reconnaissance surveys of Jamaica. He also indicated he received much help from the Jamaican government's development agency - Jamaica National Investment Promotion, Ltd. - in getting contacts and business appointments. After locating a local joint venture partner and setting up shop, the firm took advantage of OPIC's political risk insurance to protect the investment.

The host country's investment policies were also instrumental in attracting the firm. The country allows full repatriation of profits for all investments approved by its central bank; offers relief from double taxation; provides up to 10 years tax holidays for specified businesses; allows duty-free importation of equipment, machinery, spare parts and raw materials in many cases; and provides various other special incentives depending on the type of business involved. Specific investment incentives differ, of course, depending on the country, but various forms of tax relief and import duty exemptions are commonly used by many developing countries to attract foreign investment.

Thus, government programs designed to lessen the apprehensions of investors by assisting them and protecting their vested assets can and do play a key role in promoting the offshore dispersion of U.S. industries. The investment incentives provided by many developing countries are helpful, and their existence is generally a good indicator of a country's need for such investment and recognition of its importance. Such incentives may, at the very least, provide an appearance of political stability and continuity, and an indication that foreign governments are aware of the need to create favorable business environments for investment by more developed, industrialized nations.

DIFFERING VIEWS OF OFFSHORE OFFICE WORK

o U.S. Industry

U.S. industry appears to be strongly in favor of moving data processing work offshore when feasible. Based on interviews with companies already in the business, or exploring its potential, arguments in favor of the phenomenom rest on five key points:

1) the cost of labor offshore is considerably cheaper than that in the U.S.;
2) offshore labor productivity is as high or higher

than that found in the U.S., and data-entry workers offshore are generally more conscientious employees than their U.S. counterparts;

3) not doing such work offshore may be detrimental to U.S. firms that need such services, but cannot afford to do it with U.S. labor;

4) offshore data-entry operations have a positive impact on the development of third world countries; and

5) U.S. investment in the third world, in general, may help to enhance the political stability of developing nations.

For the most part U.S. Companies cite savings, particularly in labor costs, as their primary motivation for seeking offshore sites for data processing. They agree that ability to undercut the expense for U.S. labor by as much as 75% simply cannot be ignored and, therefore, the movement of data conversion work offshore will undoubtedly continue. None of the companies questioned thought that this trend would have a very significant, detrimental impact on U.S. employment in the sector.

One U.S. company representative summarized this argument as follows:

> "I don't see much effect on U.S. labor employment in numbers, because the offshore data conversion business has been going on for years ... The emerging data conversion

> market ... which is, and will continue to feed the expansion of data base systems being put in place, requires, competitively, very effective pricing on the data conversion. A lot of [that business] is done offshore now. A lot of the business we're getting, we're taking away from competitors offshore. We're not displacing U.S. data conversion companies ... If anything, you might find more people employed in the United States marketing these services than you're going to find displaced keypunchers."[54]

Another considerably larger company confirmed a need for creating marketing jobs in the U.S. At first the firm started its offshore data conversion operation to handle its own needs exclusively, but is presently seeking contracts from other firms with data conversion needs in the hopes of making its operation a profit center.[55]

The firm's Vice President of vice president of data processing claimed the company had employed about 200 data-entry personnel in the U.S. prior to transferring operations offshore, and that by the end of 1984 all would be, in effect, displaced. He hastened to point out, however, that all of the employees had been guaranteed other work within the firm and no one was simply "let go." Through attrition and relocation within the firm, all of the employees were reabsorbed into other jobs and several new marketing jobs were created.

Another argument raised in favor of offshore data processing was that not doing such work offshore may be detrimental to U.S. firms needing such services. One company official pointed out that his firm has several major customers just beginning massive archival work that they had explored doing in-house. Finding the work too costly, they postponed it until they could find a company like his, which was doing data-entry work at an economic rate.[56]

A third argument is based on the claim that productivity offshore can often be higher than in the U.S. Also, standards of accuracy and employee conscientiousness are generally higher. A spokesman for one company claimed he had originally underestimated the capabilities of foreign workers. He assumed that a standard of performance 70% of that attainable in the U.S. would be a reasonable estimate. After only one year in operation, however, he found that the company's foreign employees keyed better than its U.S. keyers who, on the average, had over five years seniority over their foreign counterparts.[57] At least two other companies confirmed the claim of higher productivity.[58] As noted earlier, higher accuracy rates for converted data can also be obtained abroad. Low labor cost which permits redundant keying is responsible for this.

Company responses to the quality of their foreign employees are generally very positive. It was admitted by one firm that, in terms of its employees, it "had its lemons ... but very few in comparison to [its] experience in the

U.S."[59] Companies' claims that workers were "conscientious", "on time", "knew their jobs" and had "positive attitudes" were common.[60]

The developmental aspects of offshore data processing were also touted as favorable results of offshore moves. The direct impact of offshore data-entry on increased employment in developing countries may be significant and quite rapid. One company started interviewing prospective employees in Barbados in May, 1983, commenced training on August 1, and began actual production in October of the same year. The operation presently employees 275 people. Eighty of them are managerial, technical and supervisory personnel, suggesting that keypunch operations, especially larger ones, may provide significant job opportunities not only for clerical workers, but also for more highly trained workers.

The same firm let approximately $1 million in contracts to local firms to refurbish its building. Besides direct employment, business opportunities and jobs may be created in other economic sectors to support data-entry operations.

Lastly, it is argued that U.S. investment in virtually any form may contribute to the stability of developing countries. It creates new jobs, raises the abilities and proficiency of foreign workers, infuses badly needed capital into generally poor economies, and in the long run, helps to raise the overall standard of living in less developed countries.

Since economic deprivation is often a root cause of political unrest, it is agrued that any attempt to bolster marginal economies may be viewed as positive for the security, stability and well being of developing countries.

A representative of one U.S. firm summarized this argument:

> "I think the offshore operations definitely have a viability, but there's also responsibility on the part of American firms that [go offsore] to help ... We worry about going to [certain countries] because of political stability, and what is going to give them more political stability is us going in there. Its kind of a vicious circle."[61]

In conclusion, U.S. industry supports offshore data-entry work because economic conditions make it not only desirable, but also a virtual necessity in many cases.

o U.S. Labor Organizations

Representatives of U.S. labor unions argue quite strongly against the movement of data-entry operations offshore. While the AFL-CIO has not yet adopted an official position in this regard, their general opposition to moving any type of work offshore is based largely on the following claims:

1) The creation of offshore work represents a direct displacement of U.S. workers which is detrimental to our domestic employment situation, and does not always have a permanent, positive effect on the development of needy countries.
2) Labor competition for jobs based on wage rate differentials is not fair or equitable, and is inherently exploitative of labor in less developed nations.
3) Moving operations of any kind offshore reduces effective control of our economy, and threatens our economic security.

Undoubtedly the most frequent argument raised by U.S. labor organizations is that for every job created offshore, one is lost in this country. Exporting clerical work to low-wage countries is simply the latest phase in a situation that has been going on for a long time. This practice is particularly evident in regard to U.S. manufacturing industries, especiallyy in the consumer electronic, shoe and textile sectors.

Labor spokespersons claim that the only difference between jobs in the service sector (specifically, offshore data-entry) and jobs in manufacturing is that the numbers of people employed in offshore offices are so small at the present time that there is, as yet, no discernable impact on U.S. labor. This, they are quick to add, should not preclude our taking steps to stop this trend, however, and may perhaps be all the more reason why we should in regard to office work.

Further, it is argued, creating such work offshore does not always have a permanent developmental impact on poorer countries, because companies always seek areas where wage rates are lower. As a country develops and its wage rates rise, it is claimed, companies located there may move to still less developed, and less costly areas in which to operate.

As one union representative put it:

> "We are opposed [to offshore office work] because its a repeat of what has happened in the manufacturing sector. Its strictly the elimination of American jobs, so that those jobs can be fulfilled by foreigners who are willing to work at a much lower rate. We feel that competing on the basis of wage rates is a no-win game, and it doesn't help anybody, except to line the pockets of the businesses. There is always some country that is so poor that its people will work cheaper than somebody else, so its a never-ending game. You keep moving around to poorer and poorer countries. It's not necessarily leading to permanent development in the countries."[62]

Union representatives state that the heart of the problem is our focus on wage rate differentials, and the effect that offshore offices could have on U.S. clerical workers. Because our economy is becoming more heavily dependent on information and white collar work, as opposed to manufacturing or blue collar work, a proliferation of offshore offices may be especially harmful to our economy. This may be particularly true as white collar work becomes more automated through the use of computers and telecommunicatons technology.

It is claimed that job growth in the U.S. is supposedly going to be in the services sector. Yet, the unions ask, if we now say that job growth in services such as data-entry will occur overseas, where are people supposed to find work in our own country, when we could be "taking away the last large group of jobs that the economy is supposedly going to have available?"[63]

Dennis Schamott, Assistant Director of the AFL-CIO Department of Professional Workers, claims "There are other ways to compete than just on the basis of the lowest wage rate. There is something socially wrong about pitting one group of workers against another to see who can work for the least. There are really other ways to run a business."[64]

He suggests that better management of companies may dismiss the need to move overseas to take advantage of cheaper labor. Many firms, he claims, have taken a short-term approach to business, have lost investment opportunities, or have not made good investment decision for long-term growth. Marketing strategies may not have been aggressive enough, resulting in lost business opportunities. In-house human relations policies may have been poor, so productivity levels have fallen. Pointing out that many other countries in which high wage rates are prevalent have often competed well with the U.S. in the international market, the question is asked: "Do you have to go to a foreign country to utilize their low wage labor, or can you do the work here through better use of technology and better work organization?"[65]

Aside from the direct adverse impact on U.S. labor, union representatives claim that locating more and more jobs offshore may also jeopardize our economic security because; 1) investment in our own economy is lost; and 2) offshore operations exist in environments which we cannot control, thereby making the investments vulnerable to adverse political developments.

It is argued that the continued relocation of work out of this country is economically unsound because we are foregoing opportunities to crate domestic jobs and new business enterprises.[66] Also, our dependence on foreign labor further diminishes our ability to function economically independently, and, therefore, weakens our country. Nationalization of U.S. investments abroad that have occurred in recent years is pointed to as evidence of this.

Offshore office work was cited by one labor representative as being particularly worthy of special consideration in this regard:

> "What [we're] doing now with shipping jobs overseas [via the use of] electronic transmissions ... is making [companies] even more vulnerable. Work that they have to have for [their] company to function, they are placing outside the realm of their control. In terms of control, what do you

> do if you're not duplicating that system here, and that system shuts down?"[67]

Duplication of offshore work in the U.S. would be extremely unlikely since it would be too expensive. Further, the desire for greater profitability is the primary reason for establishing offshore operations in the first place. Yet, it is claimed, offshore offices would be very easy to shut down, presumably because they do not tend to be very large, do not have a major impact on host country economies, and are heavily dependent on vulnerable communications and transportation networks.

In sum, movement of office work offshore parallels what has already happened in the manufacturing sector. Because office work is expected to be a major source of jobs in the U.S. over the next decade, it is argued that it would be in our best interests to forestall a trend that could be detrimental to yet another group of American workers.

o Foreign Government Officials

Reactions of foreign government officals to offshore office work are all very positive. Those countries which already host such operations are pleased with the results, while those that do not yet have such operations want them. In an informal survey, representatives from more than 20 Caribbean and Central American countries unanimously claimed that such investment projects would aid their economies and would be welcomed.[68]

Barbados has gone so far as to single out information services as a sector to receive major emphasis for development. At the other end of the spectrum, representatives of some countries knew virtually nothing about the phenomenon, but were anxious to learn more about it so they too could promote its expansion.

Development of the industry is looked at quite favorably for a number of reasons. It is labor intensive, and can generate employment rapidly. It is a "clean" industry; the heavy equipment, large space requirements and pollution often associated with other industrial enterprises do not exist with regard to the electronic office. The industry provides, at the very least, rudimentary training in computer use - a rare opportunity for workers in less developed nations. Finally, it establishes a foundation upon which further advancement in computer-related industries such as software development, technical services and data transmission may grow.

The Director of the Barbados Industrial Development Corporation (BIDC) elaborates:

> "I know from experience in Barbados ... that we can offer a lower cost location [for the industry], and answer the needs of many industrial companies in the U.S. I know too that the countries in the Caribbean can benefit from increased employment, and in the case of offshore keypunch operations, this can be fairly rapid. And I also think

> we can benefit from technical education which would ultimately set us on the path to higher levels of technology in the computer services industry."[69]

Barbados has targeted information services as an industry group which is expected to have a major impact on the objectives of the Barbados Industrial Development Corporation and the Barbadian economy. According to its 1983-1987 Development Plan:

> "The Information Services industry can be expected to generate substantial employment in the short term ... linkages with the more technically proficient computer industry ... will be sought as a means of expanding the sector's contribution to the economy ... Local participation in the Information Services Industry can come about through the establishment of service bureaus to perform offshore data processing for North American companies."[70]

The table below illustrates what, in the opinion of the BIDC, the effects of offshore data processing are in Barbados.

OFFSHORE DATA PROCESSING IN BARBADOS

- Industry Attractiveness Impact on National Goals -

Development Goal	Impact
o Increase GDP	Moderate Impact
o Increase Manufacturing Output	Low Short-Term Impact
o Maximize Exports	Moderate Impact
o Increase Employment	High Continuing Impact
o Upgrade Jobs	Moderate Impact
o Expand Local Participation	Moderate Impact[71]

Clearly, data-entry is expected to have a significant impact on job development in the country - a factor of paramount importance to development officials. They also see data-entry jobs as stepping stones for workers to gain access to higher level computer-related jobs. A Barbados Chamber of Commerce official, as well as several data-entry company officials cited more than one example of keyers developing a strong interest in learning more about computers and their applications to other tasks, such as those associated with running a business.[72]

All agreed that the foreign data-entry workers viewed their jobs and status in a considerably more positive light than their American counterparts. While keying in the U.S. clerical workers see keying as menial and mundane, the foreign workers often consider it a gateway to opportunities that did not formerly exist.

Over-dependence of countries on information services is not seen as a problem at this point by foreign governments. This may well be because the industry is presently so small, but also, perhaps, because many developing nations opt for diversification of industrial development as a key ingredient for a more stable economy. Pointing to their pasts, many countries want to steer away from heavy dependence on traditional industries such as tourism or agriculture, and their characteristic seasonal fluctuations in income and employment. A Chamber of Commerce official in St. Kitts-Nevis, a largely agriculturally-based country, affirmed the need for diversification. He also indicated that his country prefers to develop smaller industrial enterprises (one data entry firm presently employes 150 on the island), although no official policy along these lines could be cited.[73]

In sum, developing countries want either to develop their information services sector or the capabilities to establish one. As a Panamian government official indicated, his country had a trained labor force suited to the industry, and also the communications and transportion capabilities needed to support it. "We have discussed offshore data processing with American companies to some extent, and are attracted to it because of its low capital needs and labor intensiveness," he claimed.[74]

o Intermediary Development Organizations

Development organizations are in essence the "middlemen" in regard to the development of offshore office work. They view the expansion of the sector in the much larger context of economic development in general, are supportive of its growth, and reaffirm the arguments put forth by U.S.

industry and foreign governments in favor of such growth.

"The sheer number of jobs [offshore data processing] creates is the main attraction of the industry in the view of developing countries", states one official of a private, nonprofit development organization.[75] Further, "... on the psychological side of it, its a clean job ... [the industry] will have an easier time attracting workers who still see this as a more prestigious job, and certainly the governments see this as more prestigious."[76]

He claimed that negative reactions, if any, of developing countries with regard to U.S. investment in data processing or other sectores usually come from the more educated sectors, the labor movement, or, as he put it: "people who are not worried about having a job."[77] In essence, those citizens of developing countries who view U.S. investment as exploitive are those who are generally of higher economic status, and are not in need of the job opportunities that result from such investment.

A strong feeling that investment in developing country private sectors as opposed to just public infrastructural development projects was also noted.[78] According to this argument, in many cases developmental aid programs did not achieve their intended purposes. For example, while good roads may indeed have been built, they are not all that is necessary for development. Private businesses along those roads would more likely lead to the general advancement of countries. And while the wages paid to workers in these businesses may be extremely low by our standards, this should not be considered exploitive.

Rebutting arguments from U.S. labor that the flow of clerical work out of the United States should be stopped, development organizations point to the great impetus of increased international economic interdependency and the disadvantages of impeding capital flows. "Business goes where business can be done", in the opinion of one development organization official.[79] "The flow of capital cannot be stopped unless one wishes to control the economy, and this runs against the whole tradition of free trade," he added.[80]

Answering U.S. labor's claim that wage competition is our only focus when selecting business sites, an official indicated that it has never been a case of just wage rates. "If that were the case, there wouldn't be a bit of work done but in China and Inda."[81] While this is, of course, an overstatement, he continued, pointing out that higher profits are not the only motivation for many businesses offshore. For some it may simply be a matter of survival. Viewing the exploitation argument in a different light, he offered the following argument:

> "You will certainly get cases of exploitation, but it is far more exploitative to say [that we will] keep those jobs here, and pay an unacceptably high level of wage which

> will make our products unacceptable anywhere other than in our own economy. Plus, by doing so we will 'starve' [the people in less developed countries]."[82]

Not only is this selfish, it is claimed, but it could also lead to political developments abroad that are not in the best interests of the U.S. If developing countries do not have sufficient work available for their people, it may stimulate political upheaval, and/or the emigration of people to other, more developed nations. It would therefore seem to be in our best interests to create jobs for people in their own countries, which may help to stem this tide of emigration.

We have witnessed massive legal and illegal immigration to the United States from the Caribbean. Many countries in the region have their second largest, and in some cases their largest population centers in the U.S. This fact led one official to query:

> "Do you employ those people in their own countries or do you employ them [in the U.S.]?, because that's where they're all coming. Do they come up here and work illegally for sweatshop wages ... or do they stay in their own countries, where they would rather be to begin with if they could make a decent wage?"[83]

While such wages may be "miserable" by our standards, they must be viewed in the context of particular economies. Such wages appear to be acceptable to workers in less developed countries, and they're glad to have the jobs, at least at this point. Their children may not be satisfied with such conditions, but, in the opinion of at least one development official, "what we're offering, eventually, is the fact that [their children] won't have to [accept such circumstances]."[84]

In conclusion, offshore offices may indeed be modern day "sweatshops", as many have claimed.[85] Development officials tend to view them as "seedbeds", however. One summed up this argument:

> "... as long as people are working productively, it sets the seeds for upward mobility. 'Sweatshops' are part of an evolutionary process in labor mobility."[86]

II. THE PRESENT AND FUTURE STATUS OF OFFSHORE OFFICES

o Present Status

While offshore offices have existed for the better part of two decades, the arrival of electronic data processing and telematics has set the stage for new and possibly rapid growth in the industry in the near future. The number of companies entering data at offshore sites are few, however, and the impact of the phenomenon on foreign and domestic employment and economic situations is rather insignificant.

Offshore data processing facilities are predominantly located in the Caribbean region, which is clearly the most popular site for the industry. This is due to the close proximity of the region to the United States; well developed telecommunications and transportation networks in many of the countries; and the general availability of literate, English-speaking workers. Other countries including India, Mexico, Singapore, the People's Republic of China, and Ireland also host at least one firm each.

Presently, there appear to be at least 12 U.S. firms with data processing operations in the Caribbean. Barbados leads the region, hosting seven such firms, while Jamaica hosts at least three, and St. Christopher - Nevis and Haiti each host one. (See Appendix D for further information on the industry in Barbados).

In these four countries approximately 2,300 workers are directly employed in offshore offices. The largest such office in the region is the coupon sorting operation which employs approximately 1,200 people in Haiti.

It is interesting to note that at least three offshore offices in St. Vincent, Haiti and Grenada closed down in recent years. Managerial and and transportation problems were cited as causes; the ability of the employees to carry out the operations were apparently not responsible.[1] In the case of Grenada, which hosted a firm for some ten years, recent "unsettled conditions" there seemed to be the cause.

At the present time, the practice of flying hard copy to offshore sites and returning the data on magnetic media appears to predominate. Observers agree that with respect to the use of international electronic data transfer, the "high tech" offshore office is still in its infancy. Only a few firms are using two-way satellite links to any extent; the oldest has been operating for about three years.

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o Prospects for Growth

All signs indicate that the offshore data-entry industry could experience very rapid growth over the next ten to 15 years. The following quotes are typical observations regarding the industry:

> "In three to five years we expect to have 300 to 500 people [keying] in different locations [in Jamaica]. This is a large market, perhaps $50 billion by 1990."[2]

> "... this is an industry that's in its infancy stage and can only grow. All the world is going to this ... it will be just like the 'Jetsons' ... [there will be] endless demand for this service."[3]

> "I see the potential for fairly explosive growth in the short- to medium-term."[4]

> "The growth industry in Barbados has to be information services and data processing... As Barbadians acquire data processing skill, Barbados, with its investment in telecommunications, can develop software and other applications. The industry in Barbados ... has tremendous opportunity to grow and evolve, especially given ... the government's commitment to it."[5]

> "I don't see any limitations on the type of work that can be sent offshore."[6]

> "For now, any softening of data-entry markets is being offset by explosive growth of data-base services. Such growing needs will give [data-entry firms] a big market to shoot at ..."[7]

> "Barring a technological development in the U.S. which would obsolete the need for operators keying in information, I think [the industry] is going to continue to grow very rapidly. We have an increasing need

> for information, and we have a problem with our wage levels ... even if you consider the lowest end of the wage scale, you're still up against the minimum wage. If you are able to establish, as you can, good communications and transport arrrangements, then there's no alternative [to going offshore]. It makes good sense to do it."[8]

In regard to the use of satellite data transmissions to link offshore offices with the U.S., a representative of one firm stated:

> "I think [the practice] is just coming out of the 'beta test' ... and just beginning to [reach the point] where it can really move out in full force. The stability of transmission, the accuracy, the availability and the reliability [of satellite data transmission], I think, is proven. We thought the transmission would be a problem, but it is just as solid as a rock."[9]

In view of dramatic growth in the data processing industry in general, and expanding needs for digital data, the above observations seem quite justified. There is evidence of interest in establishing new data processing facilities abroad to service the U.S. Some companies already in the business have cited expansion plans.

It is known that several companies are entertaining the possibility of setting up keying operations in the Caribbean. Barbados, St. Lucia, St. Christopher-Nevis, Dominica, Jamaica, Trinidad-Tobago, and Grenada are being looked at as possible sites.[10]

Firms already in the region may be expected to expand, but the scale of this expansion is uncertain. A firm in

Jamaica that presently employs approximately 60 plans to expand to about 500 employees over the next several years (see quote above.) This growth - approximately 700% - is probably exceptional, however. The head of Jamaica Investment Promotion, Ltd. - the government's development agency - claimed they had secured contracts for another company that would require it to expand "significantly".[11] He estimated that the industry employs about 500 people in Jamaica. If the company noted above follows through with its expansion plans, the size of the industry in the country would double.

General estimates of the industry's growth in the region are rather difficult to make. While the industry has existed in the Caribbean for some time, it appears that renewed interest in it has been caused by the passage of the Caribbean Basin Initiative Act in the U.S. congress.[12] There are no specific provisions in the Act, however, that deal directly with the industry. Apparently what is attracting investors to the region is the commitment of the U.S. government to assist in its development. Early signs of success in using satellites to transmit data from the region is also attracting attention.

Based on various observations of people knowledgable about the industry, it is probably safe to assume that at least 1,000 to 2,000 additional data-entry jobs could be created in the Caribbean region over the next decade. As noted earlier, the close proximity of the region to the U.S., as well as other attractive features, make the area a prime site for expansion of data-entry activities.

In other areas of the world, it would appear that growth is quite dependent on 1) companies' willingness to establish operations great distances from the U.S. in order to obtain labor at the lowest wage rates possible; 2) the type of data they are dealing with (e.g., time-sensitive vs. long lead time data conversion work); and 3) the mode of operation being used (i.e., air transportation or electronic transmission).

Unless satellites were used to get data back into the country, it seems unlikely that time-sensitive work would be exported to areas such as the Far East or India. Air travel time to these areas can be quite long, which makes getting to the regions a rather complicated matter, particularly if time is of the essence.

Wage rates in these areas can be much lower than in the Caribbean, however. In the People's Republic of China a figure of $2.00 per day for clerical workers was cited.[13] In India the labor rate for keyers may be as little as one-tenth to one-fifteenth of the U.S. rate, which more than compensates for transport costs.[14] The president of one firm operating there claims that it would cost approximately $65.00 to key 10,000 characters in the U.S., while he can perform the same job in India for about $7.00 to $10.00, and the quality is higher.[15]

At least one firm keys data in Singapore, but it appears that this site may have been selected because the data is then relayed to its office in Australia. Presumably, transmission costs also were an important factor. It is notable, however, that a Word Bank report determined that two-thirds of the country's total output is generated through services and over 35% of these services were devoted to the production and distribution of information. The primary information sector in Singapore contributes over 24% of gross domestic product.[16] In the Far East, therefore, it seems clear that Singapore would be a promising site for expansion of data-entry work.

Despite optimism regarding the future of offshore keying, it is clear that the practice does have its limitations. For example, the practice of using international telecommunications to link offshore offices with the U.S. may not be always be feasible, and may not spur the tremendous growth some have alluded to.

Not all "raw" information (i.e., hard copy) can be readily transmitted abroad for keying. The problem here regards the inherent technical limitations of optical character readers (OCRs).

More than one industry representative has said that facsimile clarity was a significant problem, particularly if operators must process large volumes of data. One company president claimed, in this regard, that there was a "big difference between sending five or 10 pages by facsimile and sending 50,000 pages."[17] Another said that a facsimile machine his firm had once used lacked an "intuitive sense" about translating space, inferring machine commands, etc., and that they often got "garbage" from the machine.[18] An airline vice president of data processing said his company had once used scanners to read plane tickets, but abandoned the practice because the error rate was "out of sight."[19]

Some data may not be suitable for facsimile transmission simply because there is not enough information on a page to make it worthwhile transmitting. A high density of printed characters appears to be a prerequisite of sorts if a document is to be facsimiled.[20]

Finally, the use of facsimile equipment does not appear to be cost effective as yet. Facsimile transmitters may take as long as six minutes per page, "... far too long to let overseas operators compete for time-sensitive jobs," according to one firm.[21]

Commenting on the type of work that can be done offshore, one industry executive remarked, "Nobody goes offshore for pressure cooker work."[22] In reference to those who think that facsimile transmitters will allow such work to be performed offshore, he claimed they were "too far ahead. I think its a joke."[23] An executive of a major publishing house claimed that some financial data it keys must be delivered to clients in as little as 15 hours. Although the firm is exploring the possibility of setting up a data processing office in the Caribbean, the executive said that the rapid turnaround work would remain in the U.S.[24]

Advancements in facsimile technology will, presumably, solve the problems now being experienced. But the very fact that such advancements are being made may drastically reduce the need to hire operators for many kinds data-entry work. As the capabilities of OCRs improve, much hard copy data may be digitized via scanning, thus eliminating the need for keyers.

We can also expect to see documents themselves being designed specifically to make them machine-readable. Answer sheets for the Scholastic Aptitude Tests are an example of this. Registration or application forms, survey questionnaires, and numerous other documents could be designed in this manner.

Another limitation to offshore keying is "point-of-sale" entry of data, which often precludes the need for keypunching. Some department stores such as Sears & Roebuck, for example, use light wands to read bar codes on product tags, while many grocery stores use laser scanners to read the UPC (Universal Product Code) bar code printed on packaging.

In certain cases, the person making a transaction is forced to do his own keypunching. Perhaps the best example of this is the use of automatic bank teller machines to make financial transactions. High costs for data-entry have thus compelled some businesses to transfer the work to their clients.

Finally, some industries that would appear to be major clients of offshore keying services may, in fact, not be. In the insurance industry, for instance, many tasks are already automated, and most claims are entered at the point of sale by the insurance salesperson. "The insurance industry is mainly interested in moving to small cities or economically depressed areas within the U.S.," according to one observer.[25] Some banks have also adopted this strategy. Citibank has established an office in Souix Falls, South Dakota where its credit card transactions are processed by lower-cost suburban workers.[26]

This does not necessarily mean that these industries will not avail themselves to offshore data processing. It does, however, indicate that domestic keying can be done economically in some cases, which may obviate the need to go offshore.

In conclusion, offshore data-entry will probably undergo vigorous growth during the next ten to 15 years. Electronic data transmission will add a new dimension to the phenomena, as full advantage of telematics is taken. It should not be assumed, however that this practice is generally applicable to all data processing work. Economic and technical factors will probably limit facsimile transmission from the U.S., but the practice of transmitting data back into the country is likely to proliferate.

Perhaps the most important consideration when assessing the future growth of the industry regards optical scanning technology. As advances in the field permit the widespread use of scanners, and the use of machine-readable documents increases, the need for human intervention in data-entry will be reduced considerably.

When asked what the development would mean the end of offshore data-entry work, virtually every respondent claimed it would be the arrival of cost efficient, highly capable optical scanners. An executive of one company keying data offshore believes that his firm will stay as long as the cost-effectiveness of satellite transmission is not outpaced by advanced technologies that could eliminate the need for a majority of data-entry jobs altogether.

His comment - "To say that we'll be doing this for the rest of our lives is not accurate; but to say that we'll pull out in the near future is also not accurate." - is representative of observations made by several others in the industry.[27] In view of anticipated developments in scanning technology, and the technology-sensitive nature of data-entry, it would seem reasonable to assume that offshore keying probably has an effective lifetime of, perhaps, 15 to 20 years.

III. INFLUENCING THE COURSE OF OFFSHORE OFFICE WORK

PROMOTIONAL MECHANISMS

The growth of the offshore office phenomenon is a direct result of market forces working to permit the performance of the labor-intensive entry phase of data processing in the most economic manner possible. Because the cost of domestic clerical workers remains high, little more may be done to encourage American firms to continue their search for less costly labor outside the U.S. Simply stated, the market is providing all of the necessary incentives to expand the use of foreign labor, refine the practices associated with the operation of offshore offices, and increase the efficiency and capabilities of these operations.

To further encourage companies to relocate abroad, perhaps tax incentives designed specifically for data-entry or other such firms could be passed. However, offshore offices are already receiving very favorable treatment under U.S. customs regulations. Further, our well developed telecommunications and transportation networks provide firms with a wide variety of cost effective options to choose from when formulating their operating strategies. In short, because the environment in which offshore offices presently operate is so unfettered by regulatory or economic impediments, a "do nothing" approach would be sufficient to encourage the continued practice of exporting clerical work.

INHIBITORY MECHANISMS

If discouraging the practice is desired, a variety of monetary and legislative options may be resorted to. In a very broad context, actions that would weaken the dollar or bring down interest rates might, to some degree, diminish the incentives to move various labor intensive activities offshore by simply creating a more favorable domestic business environment.

Other steps may be taken, however, that could be more specifically targeted towards curtailing the practice of exporting clerical jobs. It should be noted at the outset, however, that these measures, if adopted, might have undesirable side effects which could effectively negate any gains achieved by stemming the outflow of office work. Nonetheless, while the difficulties of enacting and enforcing such measures could be very acute in many cases, their promulgation would have decidedly inhibitive effects on the establishment or operation of offshore offices.

o Protecting Data

The first strategy involves restricting the types of data that may be processed outside the U.S. This could be done in the name of protecting data to insure personal privacy. In fact, concern over privacy may be the most valid justification for government action in this regard.

Mentioned earlier was the fact that a considerable number of data protection laws already exist in the United States. They are designed to restrict the uses of name-linked data and assure access to the data by persons referenced in data. They do not, however, address the "front-end" issue of how or where information may be entered into electronic databases.

Privacy laws are passed because of the desire to minimize negative externalities arising from transactions involving transfer of name-linked data from one party to another.[1] When such data is sold or purchased, the parties involved both benefit. The reputation or well being of the party whom the data describes, however, may be jeopardized or harmed through the indiscretion, indifference or malice of the parties exchanging the information.

Conceivably, a case could be made that the privacy of individuals may be unnecessarily jeopardized if personal data is exported from the country for entry into databases. The case could rest on the fact that: 1) the risk of interception of data in transit by third parties may increase as transportation or transmission lines between entry sites and end-users lengthen, and 2) data protection laws may not exist in countries hosting data-entry operations, or may not be substantive enough to insure personal privacy while the information is outside the jurisdiction of American law.

Specific measures which could be taken in this light might include prohibiting U.S. firms from entering name-linked data outside the U.S.[2]; requiring that extensive security measures be taken to protect data in transit; or, prohibiting the export of such data to countries unable or unwilling to insure its security while under their juridiction. Such measures would clearly discourage, if not altogether prohibit entry of certain types of information offshore.

They might, however, also have far-reaching undesirable effects on the free flow of data across borders. If, for example, information on individuals' bank accounts qualified as name-linked data, such restrictions could have profound implications for the offshore banking industry. The data processing costs of mass-mailing houses would be sharply increased, since many large mailing lists are keyed offshore. Presumably, close examination of the types of data keyed abroad would be needed to define specific data worthy of restrictions.

Restricting data-entry in the interests of insuring privacy also gives rise to the problem of drawing distinctions between real and legal persons. Such restrictions would, in essence, govern what could and could not be entered into electronic databases. This issue has been debated by the French National Assembly, among others, and is dealt with in Norwegian and Danish law.[3]

In any event, to enhance privacy by singling out and restricting the entry phase of data processing might be challenged on the grounds that information may be no more vulnerable to abuse or misuse before it is digitized than after. If firms could not assure clients that data being keyed offshore would be secure, few would be inclined to move that phase of their operations offshore, or to contract out the task to firms outside the U.S., regardless of cost savings. Security of information in transit, and while at offshore locations, is more or less an a priori assumption of companies exporting the data and the firms performing the necessary processing.

It has been argued that private enterprises be allowed to provide as much or as little security as they deem necessary for the particular types of data files they have in their possession, and that government standards of computer security need not be formulated.[4] To date, it appears that voluntary provision of security measures has worked, since breaches in security seem to be rather isolated instances. Therefore, even if government concerns over privacy are genuine, it might be very difficult for authorities to build a strong case against offshore data-entry on such grounds.

o Local Content or "Buy National" Requirements

A more direct approach to discouraging establishment of offshore offices would be to simply designate data-entry as a phase of processing that U.S. companies must, in virtually all circumstances, carry out within our own borders if the data is destined for eventual sale. This would, in effect, constitute a local content requirement.

Because such a requirement implies that the data being entered is a commodity, this type of restriction may not be applicable to certain types of data - e.g., revenue, personnel, payroll information, and the like - reserved for the exclusive use of a business, since it is not meant to be sold. "Buy national" requirements could fill this gap by mandating that offshore data-entry could not be resorted to unless domestic alternatives were unavailable. Brazil and Canada, for example, have imposed regulations that require certain phases of data processing to be conducted within their own borders.[5]

If viewed in a broad context, however, imposition of such regulations may serve to stimulate reciprocal actions by other countries. Thus, more harm could be done to our data processing industry than could be counter-balanced by attempts to restrict a particular phase of data processing to our own shores.

o Restrictions on the Origin of Hardware and Software

In lieu of limiting the kinds of data that could be entered offshore or requiring that data-entry be carried out domestically, requirements that U.S. equipment be used could be imposed. Thus, a company setting up a data-entry operation abroad may be required to purchase or lease American-made computers, display terminals and other peripherals, storage devices, and software.

In essence, this would constitute another "buy national" requirement. This might effectively preclude the establishment of keying operations in many countries, since, as previously mentioned, foreign communications authorities often monopolize equipment markets and require that their locally manufactured equipment be used.

The efficacy of restrictions on equipment origins may nevertheless be moot. Many countries do not require companies to use locally produced equipment, or do not even have their own computer industry. Even if such laws could be extended to the extraterritorial operations of American firms, compliance would probably not pose any significant problems, and might not be even considered a nuisance in view of the fact that the U.S. producers some of the best computer equipment in the world.

o Discriminatory Taxation

The imposition of various taxes on international data flows and trade in services could be an effective method of inhibiting data-entry offshore. In theory, duties could be imposed on the data which is keyed offshore and subsequently imported into the U.S. by physical or electronic means; the data could be treated as some type of commodity or primary good imported for consumption. Alternatives might be to levy duties on the labor value added to data keyed offshore, or to impose a trigger price tariff that would keep the price of offshore keying above domestic levels.

In practice, however, levying any such tariffs could be a very complicated matter, particularly where electronically imported data is concerned. Also, this shotgun approach to regulation would probably affect all data importers, of which offshore keyers are a trivial minority.

If tariff treatment were extended to data, policies would have to be adopted under which formulae for valuating data could be developed. Presumably, extensive classification of data would be necessary because of its numerous types and end uses, and also because of the need to determine equitable valuations.

In lieu of such classification, tariffs might be charged simply on the basis of the volume of data imported.

For example, a duty might be levied for every kilobyte (one thousand characters) of data brought in. Establishing tariffs in this manner would seem to be inherently inequitable, however. For example, a government would be hard pressed to charge the same duty on a yard of cloth of any kind, because silk obviously has a greater value than burlap. So to does the value of information vary.

Regardless of the scheme adopted, monitoring data flows and enforcing tariff schedules would present serious problems. The same tariff treatment would have to be applied to both physically and electronically imported data, assuming, of course, that the government would not want to leave loopholes open that would allow firms to avoid taxes.

Customs officials would have considerable difficulty determining the contents and/or volume of data recordings because of the intangible nature of the commodity. Nothing short of playing back recordings on a computer would permit them to inspect data to insure against contraventions of tariff regulations.

Policing electronically imported data would pose particularly onerous technical and political problems. Digital electronic transmissions do not lend themselves well to monitoring, since voice, video and data may all be mixed into single bitstreams in transit.[5] As digital transmission of voice (as opposed to analog, which is often used now) increases in the future, it will become all the more difficult to distinguish between different types of transmissions. Mandating that certain communications channels be used for specific purposes may offer at least a partial solution to this.

Another technical roadblock to monitoring is data encryption. Coding messages via computers, mentioned earlier, renders transmissions incomprehensible to those without the means to decipher them. It is likely that encryption will be used more frequently for security purposes as transborder data flows increase.

Packet switching, which involves random routing of parts of messages through networks as communications traffic dictates, presents yet another impediment to monitoring. From a practical standpoint, monitoring such data flows appears to be virtually impossible.[7]

Finally, the sheer volume of transmissions to the U.S. and the many routes they may follow present logistical problems of inestimable proportions for monitoring. In the future, the prospect of direct satellite links between offshore installations and domestic offices will make the imposition of border controls on data flows extremely difficult, if not impossible.[8] Site-to-site transmissions via roof-top antennas would bypass terrestrial communications networks altogether.

In any case, it seems clear that on-site monitoring by government authorities and/or wiretapping on a grand scale would be necessary to police electronic data flows. Even if this were technically feasible, it is doubtful that revenues accrued by a government could, on their own, justify the efforts made to collect them.

Putting technical and economic considerations aside, moves toward monitoring data flows in the United States would undoubtedly encounter many political obstacles. For one, the practice would cast a clear shadow of authoritarianism, and have a very inhibitive effect on business and communications in general. A far greater purpose than stifling a minor industry would obviously be in order if the practice were adopted. In sum, while the objective of curtailing offshore keying could readily be attained through tariff legislation, a more tightly focused approach would seem more appropriate.

o Limitation of Dedicated Telecommunications Lines and/or Restrictions on Their Use

Limiting the availability of leased private telecommunications lines to offshore keying operations or prohibiting their use for this purpose would unquestionably deter the establishment of such operations, because it would directly effect one of the the lifelines of the industry.

Since leasing lines appears to be the most cost effective way to transmit large volumes of data across international borders, offshore keyers relying predominantly on telecommunication capabilities to operate would be acutely effected by any such restrictions.

Regulations of this sort could, of course, be applied only to the U.S. side of any communications link (e.g., the down-link from a satellite sending data to the U.S., a terrestrial cable in U.S. territory, etc.), since the foreign ends of such links are out of American jurisdiction. Nonetheless, this strategy may be attractive and very effective since the regulations could be applied specifically to offshore data entry firms without impinging on the rest of the data processing industry.

Restricting access to dedicated lines could simply be a matter of specifying a limitation on the number of lines available to offshore keyers in different regions. Implicit limitations might be achieved by imposing stiff tax penalties or surcharges on data-entry firms leasing such lines.

Several examples of this strategy in action point to its effectiveness in curtailing undesired activities. In Japan, the Ministry of Posts and Telecommunications, through the international telecommunications authority, KDD, kept two large U.S. data processing firms out of the country's market by first denying them dedicated lines, and then restricting their use so that the firms could not market all of their services.[9] The Deutsche Bundepost in West Germany requires users of leased lines to use the public data network. In 1982, the authority declared that it would permit the use of international leased lines only if some phase of data processing were conducted in Germany before data was transmitted out of the country.[10] Brazil has enacted a plethora of restrictions on the use of leased lines. For instance, firms may not use them to access databases located outside the country.[11]

Short of limiting access or prohibiting offshore data-entry companies from using leased lines, legislation could require common carriers to impose usage-sensitive rates on these firms. A number of foreign governments have expressed interest in usage-sensitive rates, since they fear the loss of revenues that would result from reduced use of public networks.[12] One international data processing service estimated that the introduction of usage-sensitive rates would raise its operating costs by 700 per cent.[13] In the face of such cost increases, many data-entry firms would probably have to close up shop.

Regulations on leased lines could, therefore, offer a relatively "clean" approach toward discouraging offshore keying; impeding other types of data flows could be avoided because restrictions could be tightly focused. To be truly effective, however, such restrictions would probably have to go hand-in-hand with some form of customs regulations so that control could be extended over both routes by which data enters the country.

o Concessionary Taxation

It seems quite possible that if more favorable treatment were accorded firms using domestic keying services, the use of foreign establishments could be discouraged. It might be considerably easier to grant additional tax relief to companies employing or contracting domestic clerical workers for data-entry, than to attempt to regulate offshore operations out of existence or make their continued operation exceedingly difficult. By undermining the reasons for which offshore offices are established in the first place, decision-makers could avoid altogether the many technical, economic and political problems that would be involved in launching a necessarily complicated legislative attack directly at them.

o Conclusions

Inaction by authorities would undoubtedly assure the continued export of clerical work, since the marketplace is clearly providing all the needed incentives. Virtually any actions to regulate the offshore data-entry industry would seem to be detrimental to it. If this is seen as a desirable objective, however, a variety of legislative measures could be adopted. Because these may have undesirable effects on other phases of the data processing industry, considerable care in selecting modes of action would be necessary. Due to the many problems associated with legislating against offshore offices, it may be far simpler to develop positive incentives to utilize domestic workers whenever possible.

Impacts of Computer-Mediated Home-Based Work on Women and Their Families

Kathleen E. Christensen

City University of New York

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IMPACTS OF COMPUTER-MEDIATED HOME-BASED WORK ON WOMEN AND THEIR FAMILIES

Kathleen E. Christensen
Associate Director
Center for Human Environments
Graduate School
City University of New York

June, 1985

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CONCLUSIONS OF STUDY

The major conclusions of this two-part national study of professional and clerical women who work at home are as follows:

1. Working at home as an entrepreneur is fundamentally different than working there as a company employee. Entrepreneurs exercise more autonomy in scheduling work, setting payment schedules, and specifying work conditions and relationships than do employees.

2. Organizational status overrides occupation when work is done at home. For example, self-employed word processors exercise more autonomy than do employed programmers. Word processors, who would be treated as clerical workers in an office, identify themselves as professionals when they own their own word processing companies at home.

3. Current company practices that define home-based workers as independent contractors run the risk of creating second class corporate citizens. Typically, they are not guaranteed regular work, leading to undependable incomes. They are not given benefits, either medical or retirement. They operate outside of the mainstream of the company, precluding opportunities for advancement or skill upgrading. As independent contractors, they are paid by the project, they are not paid for lag time between projects and they are paid less per hour,largely because they receive no benefits. They tend not to report time they spend on correcting mistakes or printing out work.

4. Women who work at home as a way of balancing child care and paid employment typically live in traditional two parent households, where the father is the major breadwinner. These women work part-time, primarily for "bonus" money and the psychological benefits of doing something other than being a full-time home-maker and mother. On average, they contribute well below 25% of the household income.

5. Women do not work and care for their children simultaneously. They must often work when their partners can care for the children, or when their children are at school or asleep. When a professional woman has dependable, steady work, she is apt to employ paid child care, in the home or outside.

6. Computer technology will not cause work to be done at home. Women work at home for value-based reasons, such as to care for their families or to start a business. Technology does not cause them to work there, it simply provides a tool that allows them to accomplish their goals. To view technology as the driving catalyst behind home-based work would be a mistake.

I. INTRODUCTION

The social realities of the 1980s make it difficult for women to work full-time and be mothers full time. Whether or not they are married, they assume major responsibility for housework and care of children, they face limited opportunities for quality, affordable child care, and they experience public criticism and personal conflict about leaving their young children in the care of others. Yet, over 60% of women with children under 17 currently work. Most of these women not only want to work, they need to work, and they need to find optimal satisfying arrangements for combining work and family.

Home-based work, defined as gainful employment occurring within the confines of the home, appears to offer an ideal alternative, for it allows these women to be worker, mother, and wife in the same place. Moreover, the children and husbands of these women are seen to benefit from having her at home during the day. Yet, how ideal is home-based work for these women and their families? No one knows.

No assessment of the systemic impacts of home-based work on the family exists, despite the fact that the media, corporations, and the federal government promote home-based work as a viable work-family arrangement. The press is replete with articles stressing the advantages of home-based work for mothers and their families (Brooks, 1984; Churchman, 1983; Gillette, 1983; Langway, et al., 1984; Somerson, 1983; Vicker, 1983). At least two hundred corporations are known to have some type of home-based work program, and indications from the business world are that that number is likely to increase (Webb, 1983; Marenghi, 1984). Congress has pending before it, the Freedom of the Workplace Bill (S. 665), which promotes home-based work for women with young children and calls for a repeal of all restrictions on work at home. In effect, home-based work constitutes a major work option in the United States that is increasingly targeted to women.

Technology is a driving force behind the promotion and creation of home-based work opportunities. Advanced telecommunication technology could allow up to fifteen million information-based professional and clerical jobs to be done at sites remote from a central office, including homes. Futurist Alvin Toffler predicts that by the turn of the century up to twenty million people will work out of their homes (Nixon, 1983; Toffler, 1980).

Underlying much of the discussion surrounding home-based work is the assumption that home-based work benefits the family. This research has been designed to examine that assumption.

The objective of this research was to assess the impacts of computer-mediated home-based work on women and their families, when the women bring paid labor into the homes. It looked specifically at the impacts on child care, family relations, design of the home, and the women's own satisfaction in trying to balance multiple roles in one place. Furthermore, it examined how the structure of work (clerical versus professional) and employment status (employed versus self-employed) interact to affect the integration of work into the family.

To achieve the objectives of the research, a two-staged research design was followed. The first stage involved a national survey of 215 women to ascertain the use and effects of computers in home-based businesses. The second stage involved in-depth, in-person interviews with twenty-four professional and clerical women in the New York City region. In both stages, all women used some type of computer technology in their work.

II. CLIMATE FOR HOME-BASED WORK

Certainly, home-based work is not new to our society. Until the Industrial Revolution, agriculture and cottage industries dominated the economy, and throughout history, certain groups such as scholars, writers, craftsmen, and artists have worked at home, seeking a measure of solitude. However, since the advent of the industrial era, other needs such as supervision, communication, and the co-operative use of resources and equipment have predominated, leading to the centralization of the workplace, first in factories, then in offices. The notion of work and family as separate and relatively autonomous behavioral spheres grew out of this physical separation of centralized workplace and home.

Now, with the recent and rapid advances in computer and telecommunication technologies, many workers can work in their homes and, yet remain in immediate contact with their supervisors, colleagues, and clients. There are at least three technological trends responsible for this decentralization of work.

First, increasing numbers of offices and office jobs are automated, relying on computers, word processors, and telecommunication technology to link work and people. Relatively conservative estimates claim that over one million microcomputers are currently installed in offices, and that the number is bound to increase dramatically. These automated offices increase the geographic flexibility of workers. They need not be in a central office in order to work. They can do office work at home on terminals hooked up to their offices' mainframes, or on free-standing microcomputers.

Secondly, the increasing affordability and accessibility of personal computers allow many people who want to work on their own in their homes the option to do so. According to Jack Nilles, futurist at the University of Southern California, 89% of all American households will own a personal computer by 1990 (National

Academy of Sciences, 1983). Personal computers have fueled the imagination of futurist Alvin Toffler, whose notion of an American economy based on electronic cottages depends on their availability (Toffler, 1980).

Third, telecommunication advances enable people to transmit information rapidly and accurately simply using computers and telephone lines, thereby allowing them to work at a geographic distance, but be accessible to supervisors, colleagues, clients and data sources. Particularly recent innovations such as LADT (local area data transport), which facilitates high speed communication over ordinary phone lines, will virtually automate the connection procedure, thereby further simplifying communications.

The combination of automated offices, personal computers, and telecommunication advances create the possibility of different flexible work arrangements, including home-based work.

Although exact figures as to the number of people who work at home on their computers are not available, Business Week reports that fifteen million current information processing jobs could be done at home (1982). According to telecommuting specialist Gil Gordon (1985), between 200-300 companies currently have some type of home-based work arrangement. He estimates that in each company between eight and ten workers, excluding sales representatives and overtimers, work in their homes. Additional corporations show interest in the possibility. For example, a New York-based consulting firm, Electronic Services Unlimited (ESU), recently conducted a proprietary study of current corporate activity in home-based work and sold it to such clients as J. C. Penny, Digital Equipment Corp., Citibank, AT&T, Xerox, General Motors, and Hartford Insurance Group.

Several of the better known corporate home-based programs include those sponsored by Control Data Corporation (CDC), New York Telephone, Blue Cross

Blue Shield of South Carolina, Mountain Bell, and Shearson-American Express. These corporate programs vary across four dimensions: structure of work done at home (professional or clerical); type of payment (salary or piece-rate); amount of time spent at home vis a vis time spent in a central office (full-time at home or part-time); and availability of health or pension benefits to employees (available or not available). Although systematic assessment is not possible given available information, some of these variations can be illustrated by examining three corporate home-based programs.

Control Data Corporation's Alternate Work Site (AWS) program conducted an in-house evaluation of twenty-three full-time salaried professionals who worked at home from one to five days a week. They found that the employees, who were known as high performers prior to starting the program, increased their productivity by an average of 35% (National Academy of Sciences, 1983). According to CDC management, the AWS program allowed them to retain good employees, and see increases in productivity, at minimal cost.

Blue Cross Blue Shield of South Carolina has a program entitled "Cottage Coders and Keyers," involving fourteen claims coders and data entry operators (Blueprint, 1983). All of these clerical employees are women who work on a part-time basis, get no benefits, and are paid on a piece-rate for each claim processed. They usually operate on a quota of 1,000 claims per week. Management expresses pleasure with this program, citing shorter turn around times for claims processing and decreased error rates (Olson, 1983c). (It must be noted that the Blue Cross Blue Shield program has been criticized for its employment practices, since it pays by the piece, offers no fringe benefits,and requires employees to pay rent on the equipment (Mattera, 1983).

Mountain Bell's program in Denver employed, at its peak, eight technically-oriented, salaried professionals who worked at home four days a week, and in the office one. An in-house evaluation found that productivity increased (National Academy of Sciences, 1983).

Overall, corporate management has expressed satisfaction with home-based work across all variations of arrangements. Besides productivity, corporations stand to gain in other ways by implementing home-based work programs. They attain employees who otherwise would be unattainable, reduce their turnover of personnel, and cut costs due to off-hour utilization of the computer and decreased needs for office space (Olson, 1983c).

In addition to corporate responsiveness, the federal government has given support to work at home through separate agency and congressional activities. In October, 1984, the Department of Labor lifted its ban on the home manufacture of knitted outerwear; in the spring of 1985 Senator Hatch (R-Utah) introduced the Freedom of the Workplace Act (S.655) into the 99th Congress, and Rep. Newt Gingrich (R-Georgia) re-introduced the Family Opportunity Act.

The Family Opportunity Act (H.R. 2531) was first introduced into the 97th, and reintroduced into the 98th and the 99th Congresses, by Representative Newt Gingrich (R., Georgia). One of the bill's purposes is to "restore the family setting by allowing families to learn and earn together at home." It would achieve this purpose by granting tax credits for home computers purchased for educational or work purposes. By granting such tax credits, this bill would promote the full-scale development of home-based work. While Gingrich has not directed his proposed legislation exclusively to women, it is clear that any legislative push for home-based work will affect women differently than men given their current social roles and responsibilities.

The Freedom of the Workplace Act is intended to provide the "opportunity for women, particularly those with small children, to work at home without all the encumberances of the Fair Labor Standards Act restrictions" (Hatch, 1985). This act would amend the Fair Labor Standards Act in such a way that any occupation could be done at home, with no special permits required. The bill is currently in committee.

When the Labor Department lifted their ban on home knitting, they opened up the possibility for federal support of other types of home-based work, such as that done on computers. Their action sparked a controversy with labor unions, particularly the International Ladies Garment Workers (ILGW), which opposes industrial homework on the ground of potentially unsafe work conditions, and possible violations to minimum wage, overtime standards, and child labor laws. The AFL-CIO and the Service Employees International Union (SEIU) have extended their opposition to computer-based homework, having passed resolutions in 1983 calling for its ban.

Despite the unions' opposition to home-based work, this administration has been intent on expanding opportunities for people to work at home, particularly women. Evidence of where it intends to go over the next four years can be found in the 1984 platform of the Republican Party, which states "We demand repeal of prohibitions against household manufacturing. Restrictions on work in the home are intolerable intrusions into our private lives and limit economic opportunity, especially for women and the homebound" (1984, pg. 9).

Collectively, therefore, the technological conditions, the economic incentives, and the political support are converging to create a favorable climate in the United States for work at home. Just as these forces are pushing the development of home-based work opportunities, the social realities faced by women who need to work or want to work are forcing them to look for viable work-family arrangements, including work at home.

III. SOCIAL REALITIES OF WORKING WOMEN

Women have entered the labor force in record numbers over the last several decades. The most dramatic increase has been seen in the participation of mothers. In 1947, only 18.6% of women with children under age 18 worked. By 1984, that figure had jumped over threefold to 61% (U.S. Department of Labor, 1984). Yet, the social realities of the 1980s make it difficult for most American women to work full-time and be mothers full-time.

Most working mothers continue to assume major responsibility for home and children in addition to their work responsibilities.

According to an international time budget study series, American working women spend more time in child care and in housework than do their husbands (Szalai, et al., 1972). Moreover, mothers of young children face criticism for working outside the home. A recent national survey found that 63% of the employed men and 52% of the employed women questioned believed that it was bad for children under six to have a mother who works outside the home (Working Mothers: Effect on Children, 1983). But, even if mothers seek to work outside the home, they encounter a serious shortage of child care services in our country.

A recent estimate was made that of the approximately 13 million children under the age of 13 who are in need of child care services, only 7.8 million are known to have them, leaving 5.8 million children in this country without any known child care arrangements (Children's Defense Fund, 1982). Although a number of factors could account for this figure of 5.8 million, one major factor is simply lack of services. Besides too few services, many women complain of additional problems related to the quality, accessibility, and affordability of available ones. Finding appropriate child care services represents a major concern for most working mothers.

And the strain shows. A recent study by General Mills Corporation (1981) found that most Americans believe that the combination of working and being mothers under the current social realities creates special pressures on women that constrain their ability to develop careers and care for their children to their satisfaction. When asked what the effects were on the family of having both parents work outside the home, the number of family members who thought the effects were negative was twice the number who thought them positive.

Yet, despite the difficulties and strains posed by trying to balance the demands of working and being mothers, the community mental health literature generally concludes that employed married women are better off emotionally than are homemakers on a number of emotional factors: life satisfaction (Rose, 1955); self-acceptance (Feld, 1963); psychiatric disorders (Gove and Geerken, 1977); and depression (Radloff, 1975). Clearly, working wives are more satisfied with their lives and themselves, experience fewer psychiatric disorders, as well as bouts with depression. In effect, employment serves the emotional well-being of women.

Working mothers are in a classic double bind. While they more than likely need to work and are emotionally better off working, they are being criticized for leaving their young children in the care of others, and they face critical shortages in trying to find adequate child care services. Working at home appears to be an ideal solution to their dilemma. Yet, evidence calls for caution.

IV EXISTING RESEARCH ON WORKING MOTHERS AND HOME-BASED WORK

Systematic data are limited. Three studies have examined experiences of diverse home-based workers (Olson, 1983c; Pratt, 1984; McLaughlin, 1981) (1).

From their findings, we can begin to identify how women who work at home view the experience.

Olson's (1983c) research focused on thirty-two home-based employees in seven corporations, including the ones discussed earlier. Pratt's study (1984) examined thirty-five home-based workers, including professionals, managers, and clericals. Her samples involved men and women. McLaughlin (1981) studied forty-five women with office-type jobs and forty-six women with sales-type jobs who worked out of their homes.

The findings of these studies must be treated as provocative indications of the potential impacts of home-based work on women, they provide the groundwork for our current research.

* A major impetus for women to work at home is to care for their children (Olson, Pratt, and McLaughlin).

* These women would rather work at home than not work at all. In fact, many of the women seem to have homemakers as their primary reference group, rather than women employed out of the home. They repeatedly claim that they are better off than homemakers who do not work (Olson, Pratt).

* If the women are career oriented, they feel that home-based work is detrimental to their career advancement (Olson, Pratt).

* Women who work at home, experience more social isolation than do men who work at home. Olson's study speculates that this may be because women are more likely to work at home as a compromise between child care and work than as a preferred mode of work. Pratt's work showed that professional women missed intellectual contact.

* Stress is mentioned as a major cost to home-based work, which according to Olson, appears to be associated with family responsibilities. The more family responsibilities that a home-based worker has, the more likely he or she is to experience stress.

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(1) Two other studies are currently in progress, but findings are not yet available. The first is a study of remote work, primarily at home, and is intended to gain insights into the implications of remote work for performance and quality of work life (Olson, 1983a). The second is a study of telecommuters in New York state (McClintock, 1984).

- Contrary to many popular notions, home-based work does not entirely substitute for supplemental child care services. McLaughlin found that the availability and quality of alternate child care services were major determinants to a woman's satisfaction with home-based work. Moreover, Pratt's research shows that the need for additional child care varies according to the structure of work. Clerical workers simultaneously worked and cared for their children, whereas professional and managerial women relied on additional help.

- Separate, permanent workspace was another determinant to women's satisfaction with home-based work (McLaughlin).

These findings are provocative in revealing that women would rather work at home than not work at all, but that home-based work is not ideal for them. When they work at home as a way of balancing work and family, they report feeling socially isolated and stressed; and if they are career-oriented professionals, they feel they are sacrificing their careers.

In addition, this research challenges the notion that women can work and care for their children at the same time. Although clerical workers continue to care for their children and work simultaneously, professional women tend to use supplemental child care, raising the question of why do clerical workers balance both responsibilities? Is it because they want to, because they cannot afford to do otherwise, or because the structure of their work allows them to care for their children, while concentrating on their jobs?

Yet, there are real limitations to this research. First, the Olson and Pratt studies primarily focus on corporate employees. As a result, fundamental distinctions are not made between being an employee versus an entrepreneur at home. Second, the studies do not systematically examine the differential effects of professional versus clerical work being done at home.

Third, the research leaves open a wide array of questions of the effect of home-based work on other members of the family, in addition to the worker. No data was collected by Pratt or Olson on the work history of the women, the specific care of children, the attitudes of husbands, or the particular temporal and spatial structures of the workday. Nor, was there any real treatment of what the family means. Clearly, the family is more than the sum of its parts, leading to some questions as to how the totality of the family might be affected by bringing paid labor into the home.

V. RESEARCH OBJECTIVES AND DESIGN

Based on the limitations of the existing research, we decided to conduct a national survey of home-based business women, as well as open-ended in-person interviews with twenty-four employed and self-employed women who worked at home doing professional and clerical work (2).

The survey was mailed to the 1200 members of the National Alliance of Home-based Businesswomen (NAHB) in October, 1984. It was designed to ascertain the use and effects of computers in running a business at home. Selected findings are included in the section on the self-employed, whereas the survey instrument and full range of responses are included in Appendices A and B.

Subsequent in-person interviews were conducted in fall, 1984 in the homes of twenty-four women. Since no existing research has provided such in-depth records of how the women define and integrate paid work into their homes, this report concentrates on these interview findings.

The sample of women to be interviewed were recruited and identified through a variety of ways. Paid, classified ads were run in several newspapers, including the Village Voice, Newsday, and Pennysaver. The readership of the first was based primarily in Manhattan; the latter two on Long Island. The first two papers are subscribed to, whereas the third is distributed free of charge. A request for interviewees was placed in the September, 1984 issue of the IBM-PC users newsletter of the greater New York area. Telephone calls were made to word processing firms listed in the yellow pages for the upper west side of Manhattan, requesting women who worked at home. In addition, we used referrals to identify companies who had people working for them in their homes. Additional efforts to locate insurance company employees, unfortunately, did not prove successful.

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(2) Admittedly, the home-based knitters in Vermont are attracting great public attention, and further more, we can assume the structure of home craftsmanship differs from the structure of clerical and professional labor. We have made the decision, however, ~~to~~ exclude the first group and include the latter two groups on the grounds of number. Over 50% of all employed women work in clerical or professional jobs, whereas less than 2% work in crafts or kindred activities (U.S. Department of Labor, 1981).

From these different channels, thirteen employed and eleven self-employed women were selected and interviewed.

Using semi-structured protocols (Appendix C), the interviews explored the following issues:

1. Work history of the women
2. Their decision to be at home and work at home
3. Pay, benefits, and structure of their work
4. Their work patterns, in space and time
5. Their work areas in the home
6. Computer equipment used in their work
7. Network of support in their work
8. Relationship with company/employer for employees
9. Relationship with clients for self-employed
10. Advantages and disadvantages to working at home
11. Career/job opportunities
12. Child care arrangements
13. Effects of working at home on children
14. Attitude of husband to their work
15. Housework responsibilities
16. Ideal work arrangement

Each interview lasted between forty-five minutes and one and a half hours, with an hour interview being the average. The interviews were tape-recorded, transcribed, and content analyzed using a coding frame developed from the transcriptions. With semi-structured interviews of this type, it is not uncommon to get different information from different respondents, resulting in "incomplete data" for all women. This has been the case, so that these interviews must be treated as exploratory, interpretative records of these womens' experiences.

DEMOGRAPHICS OF THE SAMPLE

The demographic profile of the employed was quite different than that of the self-employed (Table 1). The women were all married or living with a partner; All had children under the age of five; and were in their late twenties to early thirties. The self-employed were as likely to be single, divorced or widowed as they were to be married; they were older, with the average age of 47, and only one had a child under five. We cannot say if these differences are an artificat of our sampling methods, since the sample was clearly not a random sample drawn from a well defined or circumscribed population, or if they represent real differences between women who work at home for a company versus those who start their own businesses. Intuitively, it makes sense that starting a business requires a great deal of energy, time, and committment, all of which women with young children may choose to expend on them, rather than on a business.

The results of our interviews revealed two fundamental analytic dimensions to the experiences of working at home: employment status and child care responsibilities. Our initial assumption was that the occupation would be a third significant dimension. Yet, at least within the self-employed sample, the distinction between professional and clerical appeared non-existant.

Recent research on the sociology of work identifies five dimensions to the structure of work (Kanter, 1977). These include absorption (degree of personal/family involvement in the work), time and timing of work (the degree to which the individual can exercise autonomy for the scheduling of work), rewards and resources (monetary and otherwise), and the emotional climate of the work

Table I

Demographic Profile of Respondents

	Marital Status			
Working for One Company	Married*/living with partner**	Single/divorced/widowed	Age	Children under five
1. Programmer for Insurance Company	*		32	*
2. Programmer for Insurance Company	*		29	*
3. Programmer for Insurance Company	*		34	*
4. Programmer for Insurance Company	*		31	*
5. Programmer for Insurance Company	*		32	*
6. Programmer for Insurance Company	*		27	*
7. Programmer for Insurance Company	*		33	*
8. Programmer for Insurance Company	*		34	*
9. Programmer for Insurance Company	**		29	*
10. Programmer for Software Company	*		30	*
11. Data Entry for Software Company	*		35	*
12. Data Entry for Accounting Firm	*		33	*
13. Data Entry for Apparel Company	*		31	*
			31.2 (average)	
Self Employed				
1. Owner of Word processing Service		*	62	
2. Owner of Word processing Service	*		over 30	
3. Owner of Word processing Service			49	
4. Owner of Word processing Service		*	47	
5. Owner of Word processing Service		*	over 65	
6. Owner of Word processing Service	*		34	
7. Owner of Word processing Service	*		34	*
8. Owner of Word processing Service		*	53	
9. Owner of Typing Resume Service		*	over 30	
10. Accountant-sole properietorship	*		over 40	
11. Owner of Software Company	*		29	
			47 (average)	

(the culture of the corporation or work world) (Kanter, 1977). In an office setting, clerical jobs certainly differ from professional jobs on these dimensions. Therefore, we initially anticipated that these differences would lead to differential experiences when clerical versus professional work was brought into the home. Yet, it became clear to us that the differences between clerical and professional were overridden when a woman was self-employed. Entrepreneurs offering word processing services considered themselves professional, and consistently appeared to be more absorbed in their work, to exercise greater autonomy, and to be better rewarded than company employees, regardless of whether the employees were professional or clerical.

As a result, employment status and family responsibilities constitute the organizing themes for this report.

VI. ORGANIZATIONAL STATUS AND WORK ARRANGEMENTS

As noted previously, none of the existing research systematically distinguishes entrepreneurial work done at home versus working for a company. Part of this is a function of the belief that a major trend in home work will be in the decentralization of office work for employees. Another part seems due to the interest of the researchers (Olson, 1983; McClintock, 1981). Yet, a third part is due simply to overlooking the distinction in the analysis of the data, which clearly includes both self-employed and employed (McLaughlin, 1981; Pratt, 1984).

Yet, the preliminary evidence from our twenty-four interviews reveal that women who work for themselves at home differ from women working for one company, on a number of counts: pacing of work; pay; benefits; daily work times; involvement with technology; and dependence on work for survival. This section will describe specific work arrangements of the employed and self-employed, taking into consideration their different demographics. Moreover, it also will address the difficulties of using the term employed. The next section on "Family and Work" will explore the integration of work into the home and family.

WORKING FOR A COMPANY

Thirteen of the twenty-four women in this sample work for a company. All of them work only for one company, and the computer terminals or personal computers that they use are typically owned by that company. From the companies' perspectives, eleven of the women are independent contractors and two are part-time employees. Yet, we are considering all to be employees.

Although the term employee may not be strictly accurate, since eleven of the women are not on company payrolls, the term conveys much more of the relationship these women have to their company than do other terms, such as self-employed or independent contractor. Moreover, a recent IRS ruling, in fact, may require that these women be treated as employees for social security tax purposes (Advisory Memorandum 845 1004, August 1, 1984). According to this ruling, home-based workers who use computers and work for only one company are considered employees, not independent contractors, at least for social security tax purposes. The company must pay social security tax on them.

The term independent contractor is quite ambiguous, anyway. It is used by women such as these, who for all intents and purposes, are employed by one company, as well as by women who clearly identify themselves as entrepreneurs. Therefore, for purposes of this report, we are distinguishing the sample into those women who work solely and directly for one company, versus those women who claim they work for themselves and have many clients. In effect, the distinction is between employees and self-employed.

Demographic Profile:

The thirteen women who work for companies all live in traditional two-parent households in which the father is the major breadwinner. All, except one, made the decision to be at home pending the birth of their first child. The other decided to stay home after the birth of her third child, largely because of the lack of adequate child care. Eight of them have two children; four have one child; and one has four children. The average age for the children is 3.2 years. These are young families, and the women themselves are fairly young. Most are in their late 20s or early 30s, with their average age at 31.2.

Nine of the women work as programmers for the same company, a major east coast insurance company; the other four work for separate companies. Of these four, one is a programmer for a two-person software company; three are data entry clerks for small companies, including a women's apparel company, an educational software company, and an accounting firm. Their specific work arrangements are discussed below, with evaluations by women. Their names have been changed for purposes of this report.

Insurance Company

The nine programmers were, at one time, all full-time employees for this company; five of the nine had had supervisory positions. Each left on maternity leave and resigned her position, having decided she wanted to stay home with her baby. In most instances, the company contacted the woman to see if she was interested in doing programming at home, although for most of the women the programming was much more elementary than the work she had previously done as a company employee. Overall, the women reported deciding to accept the work for a variety of reasons. The three most frequently cited being: (1) extra money; (2) keeping up with changes in the field; and (3) exercising their minds. As one states, she needs something to do with her mind because "you really get into a rut when you are home."

They describe the work they do as programming, assembly programming, designing, coding and testing programs. They all work on dumb IBM terminals that are owned and maintained by the company (3). None of them have printers. The terminals are hooked up, via modems, to the company's mainframe at their central data processing center. The women are responsible for telephone installation charges, if they decide to put in a special dedicated line (and six of them have done so), as well as regular monthly charges. The company pays any local or long distance per call charges, although one of the women reports monthly bills of over $600 that she must pay out-of-pocket to the telephone company, before she is reimbursed by the insurance company. Most women use their own family telephone lines, and find that it is less than ideal because it precludes any one else calling in or out. This concerns them if their young children are away from home and need to be in touch with them.

At the time these women began doing work at home, they signed contracts with the company that specified in "bold print" that they were independent contractors, not company employees. They are paid by the hour (approximately $18 an hour) for each contract. They receive no benefits, including no health or medical insurance, no pension plans, and no paid sick leaves or vacations. In addition, since most had not worked at the company long enough to be vested in a pension program, they lost all the time they had accrued when they resigned the company as employees; they did not regain this time as independent contractors. It must be noted that eight of these nine women are covered by their spouses' benefit packages. Those who commented indicated that it made no difference to them how they were covered, as long as they were. One woman did recognize and note, however, that her employer had a good deal, since they don't have to pay her benefits, "I know its to their benefit not to have to pay all the extras, very reasonable for them...they consider it a bargain, they really like the at-home program." She estimates that the cost of benefits would nearly double her hourly rate.

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(3) Actually, several women were not clear whether their company owned the equipment or leased it from IBM.

Each woman works on a project-to-project basis for the company. Most, however, have signed year-long contracts, which means, in principal, that they are guaranteed work for a year. In reality, however, the yearly contract does not guarantee them any number of hours or projects. In addition, at least one of the women is not on an annual contract, which means that she signs a separate agreement for each project.

The projects are generally handled at the company by a personnel manager assigned to the work-at-home program. These projects are funneled to this person from various departments. Only one of the women we interviewed has a direct relationship with a specific company department, and she is one of only two who has a dependable flow of work. The company assesses each project in terms of its length and difficulty and then assigns a total number of hours to it. The women are offered the projects, and offered a dollar figure for the project, which is calculated on the basis of the number of hours times their hourly rate. If the project takes less time than estimated, then the women have, in effect, made more per hour. If the project takes more than the estimated time, the women are encouraged to report the overtime so they can be reimbursed. Some women do; most don't, because they consider the length of time to be their responsibility, and they fear jeopardizing their chances for future projects if they take too long to complete the one.

The company estimates that each woman will work 17 1/2 hours a week on a project. The projects vary anywhere from two to three weeks to three to four months. Unless the project is very long and, therefore chunked into stages, the women are not paid until after the project is entirely completed.

The women report lapses of varying lengths between projects. Moreover, they never know in advance when to anticipate the next one. At the time of our interviews, one of the nine women had had only one project, and did not know when the next would arrive; two had had continuous work. The six others, however, experienced lags anywhere from two weeks to three months. One woman had had ten months between projects, but the exact reasons for such a long delay were unclear.

Six of the women were very dissatisfied with the pace and rhythm of their work. One woman stated that the long intervals were problematic, because she had to readjust to working with each project. Overall, these women prefer more work, at a more regular continuous pace. Furthermore, they stressed that they'd like to know when they could anticipate this work.

With regard to pay, three of the women reported exactly what they made annually from the work at home. It averaged out to $5,120. Evidence from the other interviews indicated that this figure would hold, on average, if precise figures were available for the other six women.

Several of the women believe that their hourly rate is probably lower than what they would be paid, if they did the same or similar work in the office. One commented, in fact, that it is "probably below standard in terms of the whole market." Another claimed that it is lower because of the lack of benefits.

Although our data are limited, these women are not happy about their pay. Five expressed dissatisfaction, three of them attributing this to the small amount of work that they get; one of them noting the low hourly rate. The four who said they were satisfied with the income, acknowledged that their pay was low, but explained their satisfaction in terms of their current family situations. These women view their earnings as extra or bonus money, that they can make while being home with their children. As one said, "I feel for the amount of time that I can put in...it is a nice amount of money to make." None of the nine express any desire to change companies or cultivate their own clientele while at home, at least for now.

Many of these women believe, however, that if their husband or partner did not have a full-time, regular job that they could not and would not work under their company's work and pay arrangement. They report that if they needed to support themselves or their families, they would need a larger, as well as a more dependable, income with regular pay periods and full benefit packages. As one woman says, "If you were single or a single parent working at home, no benefits and not having a dependable paycheck would be hard."

Several of the women would like to improve their work at home in specific ways, including more challenging work, more regular, dependable work, and for at least two, full-time work. One would like to be involved in all the stages of a project, including "everything from documentation through to the coding and testing, and actually implementing a program."

At one time, all of these women were in the mainstream of their company, but now are clearly out of it. They rarely go into the office, for either work or social purposes, and the company provides no regular meetings or tooling up sessions for them. Several of the women have husbands who work for the company. They pick up and deliver printouts, as well as keep their wives informed of company news.

The participants in this particular program are all women who left on maternity leave and decided to stay home. Only one of them expresses a strong household need for money. She, in fact, would like to return to the office to work full-time, but won't because they do not offer on-site child care. The others basically see the work as yielding bonus money and keeping their minds active. As one woman claims, there is only so much Sesame Street a person can watch. Most of the women intend to go back to work, however, when their children are in school.

In conclusion, the structure of this work program changes the status of the participants from full-time salaried employees, with full benefits to independent contractors, paid on an hourly basis, with no guarantee of the number of project hours to be worked, and no benefits.

The potential danger of this type of approach is that it could result in creating second class corporate status for women who want to continue working for a company, as well as being home with their children. At minimum, they would receive no benefits or career advancement opportunities. In addition, they would receive no explicit job security, which could lead to the type of self-exploitation evidenced by some women who do not report the full number of hours worked for fear of jeopardizing their future contracts.

These women's experiences argue against any attempts to promote this type of home-work arrangement for women whose households depend on their salaries for their livelihood. It also raises the issue of whether homemakers who work part-time for bonus money may undercut salary needs of full-time office workers who work for survival purposes (4).

Software Company: Program Trouble-Shooting

Jane is a 30-year-old programmer, who works for a two-person software company. She is married, with four children below the age of seven, and lives on Long

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(4) Vary Coates of OTA has expressed concern that in their willingness to accept, or instigate, their own underpayment, the actions of these part-time home-workers could have serious consequences for other workers.

Island. She has been a programmer for ten years, having worked for a variety of companies.

Officially, Jane is self-employed, but she thinks of herself as being an employee. She worked with another man for a software subsidiary of a large company, doing "trouble-shooting" on packages that they had sold to clients. The company decided to phase out this subsidiary. Rather than leave the business and clients, Jane and her colleague decided to take it over.

The timing of this business opportunity coincided with the birth of her third child after which, she said she could not find a babysitter to care for her three children under the age of four. Her colleague suggested that she work at her home, which she has done for the last two and a half years. She refers to her colleague as her boss. He handles the computer equipment, billing, and records.

Jane is on call five to six days a week. Clients telephone her anytime from 8:30 a.m. to 7 p.m., sometimes later, she normally handles their problems over the telephone. Her telephone calls can last from fifteen minutes to two hours. In addition, she has a terminal in her basement, which can behooked up, via a modem, to clients' mainframes when she needs to be on-line to handle their problems or questions.

Jane believes that her boss/partner rents the terminal, but she is not sure. She does not pay for rentals or repairs. So far she has paid for all the telephone calls, including the long distance ones, considering the costs as part of her business expenses.

Jane works directly with clients, figures out the hours a project has taken, and submits those hours to her boss for payment. She states that the total amount of money that she makes is less than $5,000. She receives no benefits from her current work arrangement. Although Jane is on call the entire day, she does not work all the time. In fact, she states emphatically that she will not sit home, waiting for the phone to ring. If she feels like going out with her kids, she goes. She stresses that she does not work for financial need, but that if she had to make more money her entire situation would change.

Jane works, because she wants to feel constructive and useful, and to show that she can do something besides cleaning the house and being a housewife.

She recognizes that her situation would be very different, if she had to work. Were that the case, she would have to work more hours, in or out of the house, so she could afford a babysitter and benefits.

At some point, Jane would like a place outside the home that had a work atmosphere. She feels she'd concentrate better and be more productive. As of now, she tries to take care of her four children at the same time that she works. She says its very difficult and that her kids get away with murder, including getting anything they want to eat, while she is on the telephone with clients.

Women's Apparel Company: Data Entry and Inventory Monitoring

Judy is an ex-high school math teacher who quit teaching eight years ago, pending the birth of her first child. She is married and now, at 31, has two children, a daughter aged 7, a son aged 4.

Judy and her husband purchased a Commodore 60 personal computer, because she wanted "to do something, while I was home; I wanted to learn a little bit about computers, just in case, I wanted to switch professions and go into computers." She has been teaching herself, using commercially sold software.

She started working at home after a close family friend, who owns a woman's apparel company, approached her to see if she wanted to do some of his company's work at home on her PC.

At the time of our interview, she had only worked one week for the company, but hoped the work would materialize into an on-going, regular work arrangement for her. Her tasks involved putting the company's inventory on the computer and monitoring how much of it moved during the month. She used word processing and spread sheet programs in her work, having personally paid for the software.

She was paid $5.00 an hour, claiming that she was doing it as an experiment to see if the system could work and as a favor to him. Her attitude toward the pay was that "It's pretty measly." She worked a total of forty hours that week by extending her day from 6 a.m. to 2 a.m.

She liked the job, although not the hours, and would like to do anything to earn extra money while she is at home. It does not seem to matter to her whether she uses her PC or not. The main issue is extra money. She says she would do "Anything, just about anything." As of now, however, she is not actively seeking work. When asked if she was employed or self-employed, she responded that she would like to think of herself as self-employed, but that it was not really clear, since she had worked for such a short time and for only one company.

Since the work was a trial run, no explicit or long-term arrangement has been worked out. It appears that benefits would not be an issue, since she is covered by her husband's program. If the work continued it would be structured as a forty-hour week once a month to help the company do its monthly report.

Small Accounting Firm: Client Data Entry

Susan is a 33 year old-married woman, with two children, aged four and seven. An ex-secretary, she has been at home with her children since their births. She lives in a central New Jersey suburban community.

Her husband, who is a partner in a three partner accounting firm, asked her a year ago to do some data entry work for his firm at home. She is considered a part-time employee of the firm, inputting figures for clients' financial statements. She works anywhere from ten to twenty hours a week, working the upper range of hours during the firm's tax season. She earns $8 an hour, making approximately $3,000 a year. This is her money, and she spends it exactly as she likes, not considering it part of the household income.

She says the work just "fell into my lap." As her husband's company developed, he saw a need for computers, and he thought that it would be a good arrangement having her work at home. She accepted the idea, because she wanted to stay home with her kids, make some money, and feel productive. She likes what she's doing, and is comfortable with what she is paid. She receives no health or medical benefits from her work, but is covered by her husband's plan as his spouse, not employee. They have set up an IRA account in her name. She notes, however, "It would be a problem, if I didn't have a husband and I worked at home...If I had to pay for insurance, it would be a hardship. It's a lot of money." She believes that she would have to work full-time, probably outside the home, for benefit coverage, if she were not covered by her husband.

She uses an IBM personal computer that is owned by her husband's company, which is responsible for its repair costs. All of her work is done on the PC. She had had no experience with computers, until her husband taught her how to use them. She stated that she doesn't like to read instructions, and therefore, depended on him to teach her.

She really likes working with the PC, enjoying the fact that "it is exact, not as frustrating as working with people." In fact she says, she'll follow the computer anywhere it goes, including back to the office if that is what the firm ultimately decides.

She occasionally goes into the office to pick up the work or do some part-time temporary work when a secretary is out. These visits are about once a month. She has no regular in-office schedule, and would prefer none until her children are both in school.

If she has any questions or problems with her work, she generally resolves them over the phone, rather than through an on-site visit. She sees several personal advantages to working at home, including having a flexible schedule, being home with her children, and having money "to blow." But she also cites several advantages to the company. She does not charge the company for all the time she actually puts in. If she makes a mistake, she does not count the hours needed for correction. She also does not charge them for either the materials or time it takes to print the data. Regarding the latter, she feels she can do other things during printing, so she is not exactly working. As noted earlier, the company also saves money by not having to pay her benefits.

Educational Software Company: Data Entry

Sarah, a married mother of a ten and a five year old, has been at home since the birth of her first son. Prior to that time, she had been an elementary school teacher. As her children grew, however, she decided to re-tool as a computer programmer and regularly has been taking computer courses at the local junior college.

Knowing her interest in computers, a friend, who owns a small educational software company, asked her if she wanted to do some part-time work for him out of her home. As Sarah puts it, although working at home was in the back of her mind, "I wasn't going out to look for it." But when offered the opportunity a year ago, she took it.

Sarah uses a "generic" personal computer that is comparable to and compatible with an Apple IIe. Her boss owns it, charges no rental or maintenance on it, and allows her children to play with it. She considers the last a real plus to her work.

Her work consists of word processing and formatting a calculus textbook, using programs the company developed. She says the programs are difficult, and that her boss has had to train her and be accessible for assistance.

Her boss assigns her calculus problems and questions to format, she completes them, gives them back to him for review and correction. Such reviews take place in either her home or his. She never goes into the company's central office. If she has specific questions between reviews, she confers with him over the phone. She works approximately twenty hours a week, but did not work last summer, because there was no work. She's not sure she would have anyway, because working might have spoiled her sons' vacation.

Anxious to get more challenging work, Sarah states that her boss has promised her programming work to do, but so far, has not given her any.

Sarah considers herself an employee of the company, although she is paid by the hour, not by a salary, and receives no benefits. Initially, she was paid a piece-rate for each calculus problem/question she formatted, but she asked to have it switched to an hourly basis, because "I wanted more money," than she could make by the piece, since it took longer to do each than she had expected. From the interview, it was unclear how much she was paid per hour, or per year, and she stated, when asked, that she did not know what percent of the household income her work constituted. But it was clear that her family did not depend on her work for survival.

Sarah has health insurance from her husband's plan and said she did not ask for such coverage from her employer, because she did not need it.

Sarah shares Susan's enthusiasm for the computer. She thinks computers "are exciting and I enjoy working with them." They represent a puzzle to her, and she finds it gratifying to solve it. Moreover, working on a computer is status work. As she states, "If I want to have a job, I want it to have a little status; I don't want to stuff envelopes." Overall she likes working saying, "Its nice getting a check..feeling you have an outside job. It's a boost to your ego." In the next five years she would like to split her work between an office and home, approximately 3 days in the first, two in the latter, thinking she might earn more if she went into an office.

Summary Themes of Working for A Company

The employee arrangements of our interviewees can be broken into two groups: a relatively formal program of a large corporation and an informal arrangement with a small company. In the first, a number of employees participate, whereas in the latter, only one or two people work out of their homes and are generally friends or spouses of company owners. In both groups, the company was much more apt than the woman to initiate the work at home possibility.

Regardless of the type of program, the women are paid by the hour, ranging anywhere from $5 an hour to $18, depending on the work they do. Clerical work is paid dramatically less. None of them receive any benefits from the company, including, but not limited to medical insurance, pension plans, paid sick leaves or vacations. Their status is predominently that of independent contractors. Even when the women say they are employees, they appear to be paid and treated as contractors. In the case of the insurance company, management explicitly switched the status of the women from full-time employees, with full benefit packages to independent contractors, paid by the hour, with no guaranteed number of hours and no benefits. Admittedly, each of the women officially resigned the company after her maternity leave and prior to re-entering as a home-based independent contractor.

All of these women are at a similar stage of their life cycle, married with young children. Each of them states that her first priority is to be at home with her children. With the exception of one, all made the decision to be at home, prior to the decision to work at home. It appears that they would choose to be at home, regardless of child care opportunities. One did state, however, that if there were on-site child care at her employer's she would go back to working full-time there. Moreover, several stressed that when they work in an office, they are more efficient and productive. Despite this, they have all made their commitment to be home with their children, at least during the pre-school years of the children. Therefore, any discussion of their work arrangements must be grounded within that context and not generalized to other workers, particularly single parents or people who need to work for economic survival.

Any woman who was specifically asked about appropriate candidates for home-based work stressed emphatically that their independent contracting arrangement would not be appropriate for someone who needed a dependable income and benefits. If they themselves needed such, they would most likely have to leave the home to work or at least radically restructure their current arrangements. In addition, they felt that a single person would find working at home much too isolating.

Basically these working mothers see their work-at-home as a win-win situation for themselves and their employees. Since they would not be working if they had to go outside of the home, any work is a win for them. On the other hand, they state that their employers also win. According to the women, their employers get more work for their money for several reasons: (1) they pay less per hour, than they would in the office, largely because they don't pay benefits, partially because they just can pay less; (2) they pay only for the completed work, usually meaning successfully completed, since several women do not charge for their "mistakes," or any over-time from an agreed upon number of hours, and (3) they pay only when the women work. Since the women are on contracts not salaries, they are not paid for lag times between projects. In addition, the women who tally hours after the completion of a project, rather than working a pre-arranged number of hours, will not report the hours that the printer runs, even when they have to check it, because they say they can do other things.

Although these women believe the company gets more work from them for the dollar than they would from a salaried office counterpart, they are grateful to be able to work at all given their decision to be at home.

These women represent a vulnerable labor pool; they are hungry to work, and they are apt to take well below market rates for the opportunity to earn a little extra cash and feel productive. Every step should be taken not to exploit their vulnerability. Particular principles for future steps will be recommended in the final section of this report.

These part-time home-based workers also represent a potentially strong competition to office workers who need to work for economic survival. If home-based mothers continue to be willing to accept below market rates and not charge for overtime or printing time, they could undercut the chances of others to work.

SELF-EMPLOYED

Discussions by the media, as well as academics, about home-based work have focused predominately on telecommuters, company employees who substitute telecommunication technology at home for the daily commute to the office. Our research indicates, however, that the greatest proportion of people who work at home are, in fact, self-employed.

In addition to the in-depth interviews with eleven self-employed home-based women, we conducted a national survey on the use of computer technology in home-based businesses. The national survey provides basic contours to entrepreneurial work done at home, whereas the in-depth interview illustrate in much more detail how work is integrated into the functioning of the home.

National Survey of Computer Technology in Home-Based Business

In the fall of 1984, we conducted a national survey on the uses of computer technology in businesses run in and out of the home. The survey (Appendix A) was sent out in the monthly newsletter to the 1200 members of the National Alliance of Home-based Businesswomen. We received 215 responses, constituting a response rate of 18%, fairly typical of response rates for mailed surveys.

Of the 213 responses from women, 56% responded that they used computer equipment in their businesses, whereas 44% indicated that they would like to use computers in their work.

The women who use computer equipment are fairly typical of the membership of NAHB. The computer users are most apt to be white (96%), and married and living with spouses (83%). Their average household incomes are over 25,000, with 43% falling between $25,000 and $49,000 and 41% exceeding $50,000. The median number of hours these women work a week is 34.5, with a median of 24.5 at home. For 81% of the women, their home-based business constitutes all of their paid labor. Over half (56%) of the women report that their business incomes constitute less than 25% of the household income. Overall, these home-based businesswomen are most apt to live in two-couple households and supplement the husband's income.

The computer users were engaged mainly in professions (37%), service occupations (22%) or clerical work (11%). Half of them reported that they are in the business of providing office type services for other businesses, individuals, or organizations. The most frequent services offered were word processing and bookkeeping. The type of equipment used most often for their work was a personal computer (86%); and second most common was the word processor (34%). About one-fifth of the women reported having a modem, but our subsequent in-person interviews indicated that modems are not currently used with any frequency by home-based businesses, although several women did recognize their potential appropriateness. Nearly all the women owned their own equipment. They used it for a variety of work tasks, the most common being word processing, and the least common being electronic communication (Table 2).

Table 2

Work Related Tasks for Which Computer Equipment Is Used in Home-based Businesses

Type of Task	Percent of Women Using Equipment for Task (n = 120)
Word Processing	83%
Composing	53%
Data Entry	45%
Budgeting	25%
Other	22%
Businesss Planning and Forecasting	20%
Analysis and Research	17%
Communication (Electronic Mail)	15%

Although it is unclear precisely what role the technology played in the development of the business, over half of the women stated that they began their work and then subsequently obtained the equipment. Less than a third of the women started from scratch to acquire equipment and build their business. In addition, nearly 60% of the women reported that they could continue to work at home, even if the equipment was not available.

These figures lead us to conclude that although computer technology may be a sufficient condition for doing work at home, it is by no means an essential condition for most of the women. Their work would continue, even though there would be difficulties.

Complete figures and reponses to the survey are included in Appendix B. For more in-depth interpretations of owning a business at home, we would like to turn to the in-person interviews.

In-Person Interviews

Eleven of the women we interviewed are self-employed, two in partnership with their husbands, and nine in sole proprietorships. Demographically, they represent a much more diverse group than the employed.

Although six are married, three are divorced, one widowed, and one single, never married. They are, on average, 47 years old, with a range from 33 to over 65. In turn, seven have children; most of whom are teens or adults. Three have children over 20, three have children between ages 11-17, and only one has a child under 5. Interestingly, the two women in partnership with their husbands are just beginning their families; one of them is already pregnant. In effect, only one of the women has primary responsibility for a pre-school child--quite a contrast from the employed.

Eight of the women own their own word processing service. A ninth woman wants to get into word processing, but financially cannot afford the equipment. Another, who is a programmer, owns a software company with her husband. The last is an accountant in her own one-person firm.

The word processing firms will be collectively discussed since they each represent a variation on a theme. The variations will be noted, but obviously not with the detail that would be possible if each woman was presented individually. The other three women's work situations will be presented individually.

Word Processing Companies

As noted earlier, we initially assumed that the distinction between professional and clerical would override the distinction between employed and self-employed. At least with regard to the self-employed, we quickly realized that the converse was true.

We interviewed eight women who own word processing companies. All refer to themselves as professionals, capable of charting their own directions, setting their own rates according to what the market will bear, and having their work constitute a significant part of their identity. These women stressed emphatically and consistently the need for professional standards for work, demeanor, and at times, appearance. The work that many of these women do would be classified as clerical, if they were doing it as an office employee. Yet, when the work becomes part of a self-owned business the ownership aspect of the work forces it into the professional, rather than the clerical category, with attendant changes in autonomy, identity, and absorption for the worker.

Without exception, these women take great pride in their work, often likening their finished product to a work of art. One of the women, Janet, perhaps stated it best when she said "typing is a form of creating something beautiful."

The eight companies that these women own will be discussed collectively in this section, in terms of the *type of work* they do, the *rates* they charge, the *benefits* arrangement, the temporal structure of their *work days*, their professional *support systems*, as well as the kind of *computer equipment* they own, and the role it plays in the growth of their companies.

On the average, these women have worked full-time in their homes for about four and a half years, and the range is anywhere from eight months to nine years. During that time, none of them have held any other positions, part or full-time, outside of their homes. Yet, the transition to full-time home-based work was often extended over many years, as several of the women initially worked part-time at home to supplement jobs, which were either part-time or full-time jobs they held outside the home. All of them, in fact, had worked at one time outside of the home doing clerical work.

For five of the women, their word processing companies now constitute their sole source of income. For the other three, their work represents a significant portion of the household monies.

Five of the women were working as typists in their homes when they made the transition from the electric typewriter to word processing equipment, usually trying the memory typewriter first. The other three women invested in word processing equipment, in order to start their own business. They appear to have the most elaborate and advanced equipment.

All eight women offer, at minimum, word processing. Their clientele range from PhD students and academics to major corporations. Two of them have made conscious decisions to continue doing dissertation work, even though it pays less, because they find it interesting, and they feel they are offering a valuable service to students. The others, although doing some academic work, actively recruit and pursue business clients, mostly because they can make more money.

Several of the women also offer specialized services, particularly to business clients (Table 3). These include transcription, data entry, direct mail, programming, editing, and setting up information systems. One women intends to get into telecommunicating.

Table 3

Types of Services Offered by Word processing Companies

Type of Service	Number of Companies Offering It (n = 8)
Word processing of Written Texts	8
Transcription	2
Mailing Lists	2
Data Entry	1
Programming	1
Telecommunication	1
Editing	1
Setting Up Systems for Clientle	1

The equipment the women use is quite varied, although all of them own some type of word processor (Table 4). In fact, it is usually a dedicated word processing system. Two of them also have IBM personal computers, one of whom owns an IBM PC-AT, which was purchased expressly for purposes of telecommunicating. This woman, Doreen, is clearly the most sophisticated user of the technology, and the only one to have discussed the potential uses of telecommunicating in expanding her business opportunities. She intends to telecommunicate documents directly to her clients and to open a midtown Manhattan office that will be hooked up via a modem to her home office on the upper West Side of Manhattan. (A curious twist on the central office-home office relationship.)

Table 4

Types of Equipment Used By Word processing Companies (n = 8)

1. Wang Office Information System
2. Remington (RAM) Word processor and printer
3. Xerox 850
4. Norstar Computer with a Dieblo printer
5. IBM Display Writer
6. Wang Word processor and Wang printer
7. Adler Memory with CRT
8. IBM 85 Memory typewriter
9. IBM PC-AT

She views the AT as a way to learn programming and to have her work processed much more quickly than her current IBM Display Writer can do. She characterizes her decision to buy the AT as follows: "As a business person, it would be ridiculous not to purchase it. It's faster and cheaper. The fact that it computes even more sophisticatedly than this one (IBM Display Writer) does, is going to lead me into computing, in addition to word processing, because I'll find myself with a machine that does it...One thing leads to another and I'll just go with." She views the technology as the major force in defining and projecting her business's growth potential. She currently grosses over $50,000 annually.

These women charge varying rates for their products. All have an hourly rate, ranging from $10 to $30 an hour under normal conditions, and any where from $45 to $100 for rush jobs. Of the seven women who gave us their rates, three prefer hourly over piece-rates. The other four charge piece-rates for straight typing, and only use hourly rates, usually $10, for revisions of transcriptions. Page rates for double-spaced copy range from $2 to $2.50.

The women established their rates in a variety of ways, but the most common was through checking with their colleagues/competitors to see what the market would bear. Six of the eight women are all active in professional organizations, that offer both professional and moral support. Four of them, in fact, belong to the same 13 person professional guild that provides a forum for not only discussing rates, but also for business referrals. The two who are not active in an organization state emphatically that they would like to be.

All eight of these women are covered by health insurance. Four are covered through self-paid plans, three covered by their husband's plan through his work, and one through a professional organization, The Actors' Guild, in which she remains active. The women with self-paid plans accept the costs of such plans, but do point out that they are expensive.

One woman pays $1400 a year, but estimates that that cost is virtually cancelled out by the tax benefits she receives from having her business at home. Four have set their hourly rates such that the costs of medical and retirement benefits are built in. Nonetheless, the availability and expense of individual health care plans remain a concern to these women.

Doreen offered an explicit assessment of the health insurance situation for self-employed people in this country. Although clearly her comments are not limited to those people who are at home, they have relevance to them:

> I don't think it's that easy to get health care programs for people like me. And I don't know what can be done about it, knowing the medical profession like it is. I found Blue Cross rates exorbitant...for people who are not affiliated with institutions and have jobs. And I find in this country it is generally very pathetic that people who don't have jobs with institutions are uncovered. I went personally uncovered for some time before I satisfied the requirements, which meant I had to wait 8 months to get into my Health Maintenance Organization because they don't receive new people... except once every year.. Something could have happened to me, and I think that would have been terrible. And I think that the people who work in their own homes ought to have...or people who work as independent contractors should have, some way of getting immediate...coverage. I think this is something Congress could very well enact. I think this is a very great lack. I find that aspect of being self-employed is a risk...it was not easy to get it, and I was vulnerable when I was uncovered, and I'm glad nothing happened to me.

By and large business owners try to keep "normal" business hours. Six work only five days a week, beginning usually at 9 a.m., and ending between 5 and 6 p.m. Two women are more variable. The one with young children works split shifts seven days a week, typically from 8 to 11 a.m., 3 to 5 p.m., and 7 to 11 p.m. The other woman prefers working from noon to 3 or 4 a.m., the following morning, usually with a break midway through.

The women with highly structured hours do so for a variety of reasons, including: It's more professional; clients take them more seriously, when they have hours; they need their hours to overlap the working hours of their business clients; and they want to avoid overworking and burning out. In the early stages of her work, Doreen did not set hours, saying "I started out working very hard and very frenetically, and I really came very close to burn out at one point...When you work for yourself you work harder...excessive pushing, pushing, pushing." And she, along with others, stress that when the work is in your home it often is very hard to walk away from it, particularly when there are deadlines or you're striving to increase your income.

The word processing services are solid businesses to these women, providing important, if not sole, sources of incomes. Technology plays a vital role in creating new opportunities for them, as well as increasing their incomes. All note that they can make much more, largely because of faster turn-around times and ability to charge more, than they ever could working on a typewriter.

Typing and Resume Service

A divorced mother of two teenage sons, Roxanne owns a typing and resume business that operates out of her basement office. She is included in our group because she represents women who want to make a transition from the typewriter to the word processor, but cannot because of the expense relative to their income.

Roxanne owns IBM's Selectric II and III. She is a perfectionist about her work and will repeatedly retype a page of text, if it is not letter perfect. As a result, she says that she spends a great deal of time redoing work that she does not get paid for, since she is only paid for the finished piece.

She wants a word processor, because she estimates that it would cut her work time in half and would result in an increased income. She has explored leasing equipment but has found that it would cost $400 a month for a word processor. She'd estimates that she would have to generate $1,000 a month of word processing to cover the rental, as well as other costs, and to make some profit. She knows she can't.

Roxanne is caught in a double bind. She needs a word processor to make more money, keep up with competitors, and expand her range of services. But she needs more money to get one, which thus far she has not been able to generate.

Several women in the word processing business stated that a person needed to keep pace with the technology in order to avoid going out of business. Roxanne recognizes herself in that situation.

Software Company for the Food Industry

For over three years, Linda worked as a programmer for a leading Manhattan investment bank. Bored with her work, tired of corporate politics and sexism, and exhausted from days that would often stretch to 18 or 20 hours, Linda was ready for a change. She started taking a cooking class after work, and as a favor began helping her teacher develop programs for his PC that could handle his recipe files and shopping needs. She decided to quit her job at the bank and immediately began consulting to other chefs. Shortly thereafter, she conducted a survey of the food industry to ascertain whether there was an industry-wide need for software.

That was a year and a half ago. Since then, her husband, also a programmer at the same bank, has quit his job to join her in her business. The two are now developing software for the food industry. She has concentrated primarily on the programming; he on the marketing. But at the time we interviewed her, they were getting ready to switch roles. She wanted to get out and be around people, as well as let clients know that she is as active in the business as is her husband.

Largely because of the stage of their company's development, these two work very long hours. They work from 8 a.m. to midnight, Sunday through Friday, taking only Saturday off. As is typical of Manhattan, their apartment is small, and their work space is entirely interwoven with their living space. Her IBM PC is in the living room; his is in the bedroom on the floor, while the bed is in a loft directly above the computer. As a result, she claims she never gets away from the work.

Yet, having her own business in the home has been great for her. At 29, she wanted autonomy and has found it; she wants to get pregnant and not lose her job, and she has secured that. She is emphatic that having a baby "is too hard in the corporate world," largely because of inadequate child care. Regarding child care, she claims that "companies aren't doing enough." Her work at home has given her the opportunities for autonomy and job security that she wanted, and she feels that the PC was vital to making the opportunity possible. Although now tired of it, she has spent virtually all of her 16 hour workdays in front of the keyboard.

Her one complaint, like Doreen's had to do with the cost of health benefits and the unavailability of maternity benefits in most self-paid health plans. According to Linda:

> Medical coverage (for the self-employed) is terrible. The country encourages people to get out on their own and make it. But medical insurance costs make it almost prohibitive. The costs of insurance and the lack of maternity benefits on a lot of self-paid plans would have been enough to stop me from starting my business at home, had we not had savings.

Obviously computer technology opens up the possibility for increased entrepreneurial opportunities, many of which increasingly are being located at home to minimize overhead, save taxes, and to limit overall financial risk. But as Linda states, and Doreen noted earlier, the costs of adequate health coverage for the self-employed may be enough to thwart some of these entrepreneurial ventures.

One Person Accounting Firm

Daughter of a CPA, wife of a CPA, Esther finally in her 30s became a CPA. And she loves her work. A strong feminist, Esther has cultivated a predominatly female clientele, claiming that these women are increasingly tired of being patronized by male CPAs.

Her work is varied. She serves as a part-time comptroller for two Manhattan corporations; she handles income taxes for individual professionals; and she frequently works with attorneys on the tax aspects of divorce settlements, frequently testifying as an expert witness in court.

Since finishing school and her certification four years ago, Esther has worked out of her home. She shares an upstairs office with her husband who mainly works outside of the home, and she meets with clients in the dining and living areas of the home. She works alone, occasionally hiring a part-time keypuncher.

Her personal computer is indispensable to her work. Having worked as a programmer before she had her children (now aged 12 and 16 years), she was inclined to use the technology when she got into accounting. She uses a TRS 80; her husband has an IBM PC, to which she would like to switch. She needs the computer to handle a lot of her "what if" analyses for clients, claiming that changing one condition necessitates an entirely new analyses and calculation, which would be nearly impossible if she was to do it solely with the aid of calculators.

Esther knows that she makes less money on her own at home, than she would if she joined a large Manhattan firm, where she could attract big corporate clients, who would pay higher rates. But she likes her arrangements. She likes being at home, because she sees her family more and can be flexible about her dress and work schedule. She likes small clients, because she can deal with them on a more personal basis. And she likes being able to cultivate the kind of clientele she has.

She charges by the hour, typically, $40 an hour, but it varies. Simple tax returns are less; court testimony more, usually $100 an hour. She is covered for health and medical needs through a health maintenance program that her family has had for years, and she has additional health insurance through her husband's plan at work. She estimates their health insurance costs about $200 a month.

Esther works mostly 9-5 Sunday through Friday afternoon, taking off Friday evening and Saturday for religious reasons. She has "at home" days (Monday, Tuesday, Friday and Sunday) and "moving days" (Wednesday and Thursday), when she's likely to go into Manhattan for her comptroller responsibilities. She regularly takes calls in the evening throughout the year, and she works consistently through the evenings during tax season. She sets her hours to meet clients' needs. Many of them work 9-5 during the weekdays, so she is accessible to them by phone during the day, and she frequently schedules appointments at home during the evening with them.

Esther is one of those people for whom work is truly enjoyable. She grew up in a family in which her father had his business at home, and she has continued that tradition. As she noted early in our conversation, she wanted to work at home and "my ego did not demand that I put up a shingle and rent an office."

Concluding Themes

These self-employed women who work at home place a high premium on autonomy, working in their own way at their own pace, being paid what they deserve, and not being hampered by corporate policies regarding their advancements.

Although not stressed thus far, several of the women started their own business as a way to combat both sexism and ageism in the office. They felt that they were not advancing in the corporate hierarchy as high or as fast as they deserved, and they got sick of it.

For most of these women, locating their business at home was primarily a financial decision. They could limit their initial outlay and simultaneously enjoy tax benefits. At least seven of them would like at some future point when earnings allow to move their businessess out of their home. They want the separation and "professionalism" of having an office away from home. It seems in some ways that that would signify success.

Interestingly enough, three of them would like another home in which to move their work, thereby creating two homes, not a home and an office. Doreen has already started to do this. She recently purchased a neighboring apartment, which she eventually intends to set up as an office with a home atmosphere. Another woman would like to keep her business in her current apartment, and find a bigger apartment to live in. The third would like a suburban house, with an office on the property. For these women, a sense of home is continuous with their business.

Overall, these self-employed cite several advantages: (1) the flexibility of the hours to suit their life styles; (2) the control and autonomy they have to set their work and roles; and (3) the financial benefits from being located in the home rather than office. The disadvantages most often cited include the disruption to their home life and family as a result of work being done at home; the isolation; and not being able to get away from work.

VII WORK AND FAMILY: INTEGRATION IN THE HOME

As noted earlier, working mothers confront formidable challenges when they work outside the home. In addition to the demands of their jobs, they assume major responsibility for care of their children and house. They face limited opportunities for affordable, quality child care, and they often experience personal conflict and public criticism for leaving their young children in the care of others.

Yet, most of these women need and want to work, and they need to find optimal, satisfying arrangements for combining work and family. But is bringing paid labor into the home the best solution, for these women?

The purpose of this section is to examine the realities that women face when converging paid labor and child care in the home. We will focus on the fourteen women, who have one or more children under five years.

This section will emphasize primarily the home/family aspect of home-based work, focusing on issues related to: child care; time and timing of work; boundaries between work and family; and the supportiveness of husbands to their wives' working arrangements.

The fourteen women include the thirteen employed and the one self-employed word processor whose demographics and work arrangements were described earlier.

Of the eleven cases on which we have information, five live in households with incomes that range between $25,000 and $50,000; six in households with incomes over $50,000. In only one case does the woman report contributing a substantial amount (20%) to the household income. Overall, these women live in traditional two-parent families, in which the husband is the primary breadwinner.

CHILDREN AND WORK: SEEKING THE BALANCE

All fourteen women are at home because of their children. All worked outside the home prior to having children. In all cases except one, the decision to return home was related to the birth of their first child. One woman echoed the sentiments of all, when she stated that "I decided I could not leave him with anybody...I think it's definitely better for the child for the mother to stay home."

Although all of these women made the decision to stay home prior to having any specific plans to work there, at least eight of them had a vague idea in the back of their minds that they wanted to work at home. Clearly, working at home was not a part of a grand design to combine work and family. Yet, when offered the opportunity, the women readily accepted, offering sentiments such as: "They asked me and I really jumped at the chance," or "It was too good to be true," and "It fell in my lap." They gave a variety of reasons for why they decided to accept the opportunity (Table 5), including the chance to earn extra money, to exercise their minds and feel productive, and to keep up with the changes in their field.

They make statements about their work such as: "It's like being on vacation;" "I have something to do, so that my mind can keep working;" "You really do get into a rut when you are at home;" "I can do something besides cleaning the house and being a housewife;" "It's a boost to your ego;" I feel I'm not being

Table 5

Reasons Cited to Accept Work at Home

Reasons to Accept Work at Home	Number of Women (n = 14) Citing Reasons
To make extra money	9
To exercise one's mind and feel productive	6
To keep up with changes in the field	5
Because she had enjoyed her work in the office	4
To eliminate the commute	1

wasted." Finally, as one programmer who left a managerial position to be at home with her little girl, stated, "I had worked for so many years and you feel like your mind goes stale after awhile when you are watching Sesame Street; so it was nice to feel that I can still do this."

Although working is a financial and psychological bonus for most of these women, it is an economic need for two. One woman claims that her family is "almost dependent" on her work for a lot of the extras, like a vacation home; another states simply her household needs her money.

TIME AND TIMING OF WORK

On average, the women work 20 hours a week. All work week days, and eight work some weekends. When asked what determined the times they worked, thirteen cite family factors and six cite employer policies or client demands.

Most of these women rely on a combintion of support from husbands, sleep and school schedules of children, and babysitters to free up sufficient blocks of time to concentrate on their work and care for their children (Table 6).

Table 6

Family Factors Affecting When the Women Work During An Average Day or Week

Factors Affecting When Women Work	Number of Women (n = 13) Citing the Factor
When husbands/partner can watch children	10
When children are asleep	9
When children are playing by themselves at home and/or in a good mood	7
When children are at pre-school and school	6
When children are with a babysitter in the home	5
When husband is asleep	1

Family schedules constitute only half of the equation determining when the woman works. The other half has to do with the employer or client's schedules. Employees who work on terminals hooked up by modems to their companies' mainframes have to set hours according to their company's schedules (Table 7).

Table 7

Work Factors Affecting When the Women Work During an Average Day or Week

Factors Affecting When Women Work	Number of Women (n = 6) Citing the Factor
Company computer down on Sundays, so they work only other six days	4
Access to company computer and personnel best in morning	3
Company computer not up until 6 a.m., so must wait	1

As a result of balancing family and employer's schedules, all of the women work split shifts (Table 8).

Table 8

Schedule of Daily Work Hours

General Blocks of Times of Daily Work	Specific Times Worked by Women (n = 14)
Morning hours, plus additional later hours	1. 4 am - 8 am, plus night
	2. 9 am - 11 am; 3 - 5 pm; possibly after dinner
	3. 9 am - 12 pm; one hour later in day
	4. 6 am - 10 am; 10 am - 12 pm; 10 pm - 2 am
	5. 6 am - 8 am; 9 - 12 pm; 3 - 4 hours in afternoon; 10 pm - 2 or 3 am
	6. 9 am - 12 pm; 8 pm - 10:30 or 11 pm
	7. 10 am - 11 am; one or two hours in the afternoon; 8 - 10 pm
	8. 8 am - 11 am; sometimes afternoons
	9. 8 am - 11 am; 3 - 5 pm; 7 - 11 pm
Evening Hours Only	1. 9:30 pm - 1 am
	2. 7 pm - 11 pm
On Call	1. 8:30 am to 6 or 7 pm
Afternoon Only- Unclear	1. Hours Vary
No Set Schedule	

Nine of the women work morning hours, as well as hours later in the day; two work only evening hours; one works only after noon; one is on call during business hours, with no set amount of work; and one has no set hours.

Only one woman we interviewed depends solely on a babysitter to structure her work schedule. She has decided she wants to work regular hours (and is lucky enough to have consistent work), so she hires a babysitter to come in five mornings a week from 8 to 11 am to watch her infant son, while she closets herself in her upstairs office. Her case is unique in two ways: the dependability of her work and her unwalvering commitment to set hours. She also is the most satisfied with her work arrangements, despite the fact that she had to contend initially with her husband's skepticism, as to why she needed a babysitter while she was at home. He thought she'd be able to work during the baby's naps; she found otherwise.

Data on these women's work hours challenge two important assumptions underlying the promotion of home-based work for mothers: (1) the assumption that working at home gives the women control, and (2) the assumption that women simultaneously can care for their children and do their work. Our research shows that women, in fact, define their hours in response to the schedules of other family members, as well as of their employers, thereby constraining their control. Furthermore, few even attempt to concentrate on their work and tend to their children at the same time. Most of our sample ends up working split shifts that can extend their days anywhere from 4 a.m. to 3 a.m.

The women are not particularly pleased with their work schedules. They resent the constraints posed by family schedules, as well as employers' schedules (Table 9).

The two women with highly dependable work exercise greatest control over setting boundaries between work and family. The more a woman sets her hours and ensures that they are bounded spatially, temporally, and psychologically, the better the work arrangement is for her.

ATTITUDE TO PAID CHILD CARE WHILE WORKING

Women in our sample express differing attitudes toward using paid child care in their homes while they work. Yet, there is no systematically clear-cut connection between holding a certain attitude regarding paid child care and the women's actions.

Table 9

Sources of Dissatisfaction with Work Schedules

Sources of Dissatisfaction	Number of Women Citing this Source (n = 14)
Resents having to work nights, because she's tired or unmotivated	4
Resents having to work nights, because maintenance job is on mainframe computer, resulting in "garbage" on the screens	4
Unhappy about doing work on top of other housework	3
Resents the fact she must revolve her work schedule around her family's schedule	3
Finds it difficult to work with children around, due to their noise, disruption	3
No one is at office when she is working, so nobody can answer questions she has	2
Resents having to work on weekends, but finds she must	1

Five stress that they stay at home primarily to be with their children; that they do not favor any form of paid child care; and that they do not use any. For these women, their attitudes and behaviors are consistent.

Six of the women, however, reveal discrepancies between their expressed attitudes and their actions. Their attitudes range from stating simply that they stay home to care for them to stating emphatically that they did not want to give their children to strangers. Yet, despite their attitudes, all of these women rely periodically on some form of paid child care while they work.

One of these woman notes that it works out pretty well, as long as her son is happy with whom he is playing, and she feels confident that he is well taken care of. Another says that the problem for her in working at home and having a babysitter there at the same time is that it takes a while before her kids get used to the sitter and stop disturbing her during her work.

EFFECTS OF WORKING AT HOME ON CHILDREN

When asked what effects their working at home have had on their children, seven of the women report favorable effects, while five claim neutral, and three adverse effects (Table 10).

Table 10

Effects of Working at Home on Children, As Perceived By Their Mothers

Reporting Positive Effects (n = 7)	Number of Women Citing Effects (n = 14)
Children have learned computers	6
Children learn that their mothers can do more than cook, clean and care for them	4
Children have become more independent	2
Children treat working as a game they can help play	2
Reporting No Effects (n = 4)	
Children don't even pereive their mother's work so aren't affected at all	4
Reporting Adverse Effects (n = 3)	
Children have less time with mothers	1
Children do not get much attention	1
Mother becomes impatient when under pressure	1

The positive effects are related to two factors: access to computer technology and the psychological benefits of seeing women as more than just housewives. Four of the women stress the significance of their working at home as a role model for their children, particularly their sons. One woman comments that it's good for her sons "to know that women do other things besides staying home, cleaning, and cooking. Yet, I'm still there for them." Another says she _hopes_ her working at home will affect her children in ways she has not yet seen, including the hope that her "children will know that mommy can do something other than cook, and that I can do something and get paid for it."

When a woman notes no effect on her children it generally means she does not work when they are around, hence they are not even aware she is working.

The adverse effects are definitely tied to the amount of time the woman spends working, as well as the pressures she bears in meeting deadlines.

HUSBAND-WIFE: IN TANDEM OR ANTIPATHY OVER WORK AT HOME

According to the women, over half of their husbands are in full support of their working at home, whereas the remainder range from neutral to negative (Table 11).

Table II

Husband's Attitude to His Wife Working at Home, As Perceived By Wife

Husband's Attitude	Frequency
Wholly Supportive/Positive	9
Neutral to Positive	1
Neutral	1
Neutral to Negative	1
Negative and Positive	2

The wholly positive views are expressed as "he thinks it's great; he's happy about it," because she doesn't have to leave the home, and yet he knows how important work is to her. Another woman reports he is glad for the extra money, since he knew she wasn't going to leave the child. In addition, five of the insurance company women are married to men who work for the company. They help with programming problems, act as couriers between office and home, and keep them up-dated with office information. The husband of the self-employed word processor helps out in all aspects of her work, particularly in terms of picks up and deliveries.

The combination of neutral and positive is expressed in terms such as "If I have to get something done, he usually works around my schedule too." He knows it is important to her, he doesn't really care, and it would not matter to him if she stopped working. In fact, he claims her working may not be financially good for them, since they'll have to pay higher taxes.

The neutral view is expressed simply as "He does not mind," because he knows she like and enjoys it.

The neutral-negative is revealed as "You're working again?, he didn't mind." She went on to say that he had no objections, if she gets all her household chores done before working.

The combination of positive and negative takes the form of obvious trade-offs, such as he likes the money, but not the times, saying "he doesn't like it when it interferes with me doing other things (such as the housework). He tells me it makes me more nervous."

Overall, most husbands are supportive or at least non-contentious about their wives working. Where there is opposition, it generally takes the form of perceiving the work as an interferance with her role as homemaker. Even those husbands with mixed feelings, however, do not actively oppose their wives' working.

if their husbands change at all as a result of the women working at home, it is in the sense that they spend more time with their children, so their wives can work.

LOCATION OF WORK

Seven of the women physically separate their work space from the remainder of their house; four of them share their work space with their children; and two share it with their husbands. Physical separation of work is critical, as is setting up the work space with an office-like atmosphere. When the women have a separate space, even when it is in a closet, they take pains to give the space a "profesional" look, with office equipment, plants, posters, or other design aspects that clearly signal that this space is for work. Several women whose work space is in an extra bedroom or a basement speak with pride of "my office."

The most-frequently used space for the office is a spare bedroom. And the basement and family room are next most frequently used (Table 12). In most cases, the work spaces are set up with household furniture. Only one woman gave special attention paid to lighting and an ergonomically designed chair.

Table 12

Work Spaces Most Frequently Used

Work Space	Number of Women Citing Prime Workplace
Spare Bedroom	6
Basement	3
Family Room	2
Dining Room Table/Basement	1
Separate Room, off Kitchen	1

When the women discuss the choice of their work space, the critical determining factor is simply its availability. Nine of the women state that they plan to work outside of the home, once their children are older and in school.

HOUSEWORK

The overall situation for these women is that they are, as they were before working at home, responsible for housework, even if they do not actually perform all the chores. They manage the house, either doing the work themselves or delegating it to other family members or to paid help. Seven of the women report that their husbands help occasionally; four currently hire help, and the rest are intending to. In effect, these women are about as likely to depend on paid help as they are on their husbands for cleaning the house. This pattern of the division of household labor is consistent with existing research on housework, regardless of whether or not the women are gainfully employed. It appears, therefore, that neither employment status or location of work makes any difference to the division of labor in the home. It still falls predominantly to the women.

Of the six women who revealed their attitudes to the situation, four expressed discontent, whereas two accepted the situation. Characteristic of the discontented, one woman stated "I find its rough; I find my day is either work or running errands, or cleaning the house, and I really don't have any time to myself or my children." Those who are accepting either have a very relaxed attitude toward housework, such as "what gets done, get done," or tend to blame themselves for not having encouraged their husbands early in their marriage to help out.

Only a few of the women discussed the boundaries between paid work and housework. One has very set boundaries. She is the programmer who works from 8 to 11 am, while the babysitter watches her child. She cleans her house only while he naps and hires a cleaning service for major cleaning. Boundaries for the other women are more permeable. One woman talks about running back and forth among vacuuming, the printer, the kitchen, and the terminal. Other women say they sometimes cook while the printer is on. Most of the women try and block out the time to work and not attend to cooking or cleaning during most of that, but they occasionally do cross the boundaries.

ADVANTAGES-DISADVANTAGES-TRADE-OFFS

These women sum up their experiences of working at home in terms of advantages, disadvantages, and trade-offs.

The advantages (Table 13) are directly related to child care and to finding some balance between earning money and caring for their family.

Table 13

Advantages of Working at Home

Advantages	Number of Women (n = 14) Citing This Advantage
Being able to stay home with children	11
Making money	10
Control over working time/and life	9
Psychological reward of working	5
Not having to commute to work	5
Not having to buy work clothes	4

There are definite disadvantages to the arrangement, however, (Table 14), most specifically the isolation that comes from working on one's own at home.

Interestingly, the issue of control is perceived in terms that are both advantageous and disadvantageous. The same number of women who laud work at home, because they can control when and how they work, express resentment at having their schedule ricocheted about by the schedules of their family and their employers.

Table 14

Disadvantages of Working at Home

Disadvantages	Number of Women (n = 14) Citing This Advantage
Social isolation	10
Limited control over work times, due to family and/or employer schedules	9
Difficulties in discipline self to work	5
Work is in addition to responsibilities of children and house	3
Inadequate pay, compared to working in office	3
Lack of clear procedures with employer for getting instruction	2
No benefits	2
Limited professional advancement	2
Long hours	1

One woman said that if she didn't have a young baby, there would be no advantages to working at home. Since her first priority is her infant, she is willing to put her career on hold and face the isolation and other difficulties in adjusting to work at home.

Most of these women see working at home as a tradeoff. They are willing to trade off sociability, pay, benefits, and free time in order to be home with their children and to make some extra money. If they are career oriented, which some of the programmers are, they view working at home as a life cycle decision related to their desire to be near their children when they are young.

When asked if they feel working at home increases or decreases their career or job opportunities, nine women believed it increases them, because they can keep their hands in the field. When asked the same question in comparison to their advancement opportunities had they stayed in the office, seven state it decreases their options. In effect, working at home increases opportunities compared to staying home and not working, but it decreases opportunities relative to being in the office.

SUMMARY THEMES

The mothers who are most satisfied with their home-based work arrangement are those with steady dependable work. Their work role is much more consistently defined. They exercise control in creating definite temporal and spatial boundaries between work and family. They establish set hours for work and do not allow themselves to be interrupted by other demands. If setting these boundaries means hiring a babysitter in the house, creating a separate private work space, or enlisting the support of their husbands, they do it.

The women with irregular, undependable flows of work have to readjust every time they begin to work and are much more likely to have very permeable boundaries between work and family. Such permeability often leads to resentment and precludes a consistent definition of a working self. If the women do not have a clear and serious definition of themselves as workers, they find it difficult to establish spatial and temporal boundaries between work and family roles. A vicious cycle involving lack of clear role definition and lack of boundaries sets in.

In some ways, it is erroneous to talk about the integration of work into the family for most of the women. Integration involves a re-arrangment or re-ordering of existing pieces to accommodate the new. In effect, it is probably more correct to talk about the addition of paid labor to the women's existing responsibilities for child care and housework. Paid work typically is pushed into times or spaces left over after the needs of children and household have been met.

VIII CONCLUSIONS AND RECOMMENDATIONS

Any discussion about home-based work must make some critical distinctions about paid labor in the home. First, working at home as an entrepreneur is fundamentally different than working at home as a company employee. Second, companies that hire people as independent contractors rather than employees run the risk of creating a vulnerable labor pool and a second class corporate citizen. Third, efforts to promote home-based work for working parents, particularly working mothers, are premised on assumptions that are highly questionable in light of our research.

SELF-EMPLOYED VS EMPLOYED AT HOME

A popular fiction surrounding home-based work is that it automatically enhances a worker' autonomy. Such fiction fails to distinguish the realities of being self-employed at home versus a company employee.

The eleven entrepreneurs we interviewed are older women (mid-40s and up) who are not likely to have pre-teen children at home. They tend to work for economic survival, and their work constitutes a significant dimension of their self-image. Technology serves as a major catalyst in defining their market and ensuring their business's growth potential. Although their initial decisions to locate their businesess at home were based on financial reasons, their subsequent desire to keep it there depends more on how significant the home atmosphere is to their enjoyment of working.

Entrepreneurial home-workers possess the autonomy to set their own rates according to what the market will bear and to recruit and monitor their flow of work. As a result of this enhanced autonomy, the self-employed word processors in our sample characterize themselves as professionals, even though the work they do would be considered clerical if done in the office.

The complaints of the self-employed have more to do with their employment status, than their home location. They specifically complain about the high cost of medical benefits for individual self-paid plans, as well as the lack of adequate professional and moral support systems.

Just as the entrepreneurs can guarantee their status at home, company employees most likely cannot. Although companies can hire full or part-time employees to work in their homes, all of the research indicates that the most common practice is to hire home-based workers as independent contractors. As independent contractors, these workers are usually paid by the piece or by the hour and receive no benefits. Typically, they are not guaranteed a number of hours or contracts. This type of arrangement breeds financial insecurity, insofar that their income fluctuates according to work flow. Since the number of hours are generally much less than those worked by a full-time salaried counterpart, their pay is concommitantly less. For example, one of the insurance company home programmers made over $25,000 annually as a full-time employee, but grosses less than $7,000 as a part-time home-based independent contractor for the same company. The woman is paid only for the work she does, not for the lag times between projects, and she receives has no guarantee of work over time. In addition, as an independent contractor she loses all of her medical, pension, sick leave and vacation benefits, further decreasing her income.

Any federal policy concerning work at home must recognize the different realities between working for oneself at home, where tremendous autonomy can be exercised, and working for a company, where such autonomy is constrained by company practices.

INDEPENDENT CONTRACTORS AT HOME

Although the evidence is limited, small companies who need home-based clerical or professional personnel, are more likely to hire them as independent contractors than as employees. Their cost savings are substantial: they save on overhead, salaries, and benefits. In addition, they have access to a motivated, available labor pool: experienced women who have made a priori decisions to stay home with their children, yet who are hungry to work at home. These women are willing or financially able to accept work on a contracting basis. This arrangement puts the women in peripheral and static positions vis a vis their companies.

Independent contractors are generally out of the mainstream of the companies. They rarely are brought into the office for either tooling-up sessions or social events, such as holiday parties. Some women stay connected to the social fabric of the company through husbands who are employed there and who act as couriers. But these connections are indirect and coincidental.

From the perspective of career mobility within the company, home-based workers are treading water. In fact to carry the analogy further, some of the women feel they're skating on thin ice—one false move and no more work. This practice of independent contracting breeds insecurity, and it is questionable if it enhances company allegiance. Although the women feel grateful and endebted to the company for being allowed to work at home, they are candid and forthright about the fact that the company is getting a great deal.

In conclusion, independent contracting runs the risk of turning home-based workers into second class corporate citizens, denied the right and benefits of full-time employees.

Given this state of affairs, the adequacy of home-based work for mothers must be examined, since they constitute the most likely labor pool for this arrangement.

HOME-BASED WORK AS A WORK-FAMILY ARRANGEMENT

Current efforts to promote home-based work for professional and clerical women with children, are premised on assumptions that are at least limited, if not faulty.

The first assumption is that women simultaneously can care for their children and work. In fact, most women don't. Our research strongly shows that in order to work, women either rely on their husbands or supplemental child care, or work when their children are out of the house or asleep. When women do not use other forms of child care, they extend their days to accommodate work. By rising well before their children are awake, or by working deep into the night while they sleep, these women get their work done in the quiet and isolation they need. Their days are stretched anywhere from 4 a.m. to 3 a.m.

The image of the woman at her kitchen computer terminal with her baby quietly behind her is more fiction than fact, and entirely underestimates the amount of time and attention women want and need to give both to their children and work.

The second assumption is that they like working at home. Well, they like working there better than not working. But when these women have primary responsibility for child care, they report the combination as isolating and stressful. Furthermore, they express resentment that their hours are defined in response to the demands of their family or employer. Moreover, if career oriented, they report that working at home hurts their career options for advancement. Yet it must be stressed that most of these women see their decision to work at home as a stage in their children's life cycles. As the children get older, they intend to leave the home to work, initially on a part-time, eventually on a full-time basis.

The final assumption is that working at home enhances their control. Control is an ambiguous issue for these women. On the one hand, they have the control to schedule when they work. But given the fact that most of these women work in addition to their traditional responsibilities for housework and children, they schedule their work around them. In effect, their control appears more illusory than real.

POLICY RECOMMENDATIONS

Company Policies

Any public or corporate policy regarding company employees who work at home should safeguard the following principles:

1. Home-based work as only one type of child care. People who work at home should have access to other forms of child care for two reasons. The first is to provide them the option of returning to the office; the second is to allow them to work at home during the daylight hours. The availability of alternate forms of child care will also ensure that the choice to work at home is, in fact, a choice freely pursued and not one forced on them because of the lack of other options.
2. Equal pay for equal work, regardless of place. If paid on an hourly or piece-rate, people who work at home should receive what their counterparts get in the office. This should include the provison of benefits.
3. Minimum work, not just mimimum wage. People working at home as employees or independent contractors with sole source contracts should be guaranteed a steady, dependable flow of work to ensure dependable incomes.

4. Equal status. Workers at home should be afforded the same or comparable benefits as those in an office would receive, including opportunities for the upgrading of skills and career advancement. They should also have a clear understanding of their status vis-a-vis the company.

Small Business Policies

Any efforts to promote or safeguard women starting their own businesses at home should recognize the following principles:

1. The vital role of technology in home-based businesses offering office services. Self-employed word processors earn more than do self-employed typists. Not only do they charge more per hour or piece, they can produce more in a given period of time. Yet, given the fact that most of the businesses we encountered are initially undercapitalized, computer technology constitutes a major and often unaffordable investment. Efforts should be made to assist in the financing of computer technology for small business.

2. Critical need for information. This is a fairly obvious need for any new business, but it is one that is particularly salient for home-based businesses given their geographical and social distance from business centers. The women we interviewed report that professional support networks proved more helpful than government sponsored groups or forums. Even though the SBA does offer business assistance, it has not proven particularly accessible or helpful to the women in their business endeavors. In addition, although several professional networks and newsletters for home-based businesses currently exist, most of the women we interviewed were not aware of their existence.

3. Affordable and adequate benefits. Regardless of their work location, the self-employed encounter formidable expenses in procuring adequate medical

coverage. Several of the women point to these expenses as posing a serious stumbling block to their initial efforts to start a business. In addition, self-paid-plans do not always offer a full range of benefits. For example, one woman found that several major companies did not offer maternity benefits, and when she found one that did, it was prohibitively expensive.

CONCLUSIONS

Despite the labor unions' opposition, political, technological, and social forces are converging to create a climate favorable to paid labor in the home. The Department of Labor's 1984 ruling on home knitters created a legal precedent for computer homework. Advanced telecommunication technology could allow up to fifteen million information based office jobs to be done elsewhere, including the home. And economic and social realities faced by working mothers predispose thousands of them to look for work they can do at home, rather than in the office.

Clearly, home-based work constitutes an alternative for working women. But it is far from ideal, and it should be chosen not pushed on them, due to limited opportunities for child-care, part-time flexible work, or corporate advancement. To ensure this, any discussion of the viability of home-based work for women must be grounded in the political, economic and social realities faced by working women in the 1980s.

Acknowledgement: I want to thank Nina Gottlieb and Ahuva Windsor for their assistance on this research. I also appreciate the cooperation of Marie MacBride and the National Alliance of Home-based Businesswomen in distributing the National Survey on Computer Technology in Home-based Businesses.

APPENDIX A

Survey Instrument for National Survey on Computer Technology in Home-based Businesses

COMPUTER TECHNOLOGY IN HOMEBASED BUSINESS

SHOULD YOU FILL OUT THIS QUESTIONNAIRE?

Yes, if you are a woman who currently uses computer technology (terminal hooked to a mainframe computer, personal computer, modem, or word processor):

- to do office work for other businesses, organizations or individuals for fee, commission, salary, or by contract or job order.

- to do office work in your own business for keeping track of records, accounts, or correspondence.

- to do research and writing in your own paid work.

Yes, if you are a woman who would like to use computer technology

- for office work for other businesses or for your own.
- for research and writing.

WHY SHOULD YOU FILL OUT THIS QUESTIONNAIRE?

Your responses will help the Office of Technology Assessment (OTA) of the United States Congress to understand how microelectronic technology is allowing office work to be done at home, and what effects this may have on those who do the work. The findings will be used by OTA in its study of office automation.

YOUR RESPONSES WILL BE KEPT STRICTLY CONFIDENTIAL AND ANONYMOUS

SECTION I. (Please ignore numbers; they are for tabulation only.)

What is your current occupation? (Please check only one answer.)

7-1☐ Manager
2☐ Professional
3☐ Technical
4☐ Sales
5☐ Clerical
6☐ Service
7☐ Craftsperson
8☐ Other - please specify:

Do you currently own a homebased business or work in your home?

8-1☐ Yes 2☐ No

(If your answer is no, please go to Section V.)

Has your occupation changed because you are working at home?

9-1☐ Yes 2☐ No

SECTION II.

How many hours do you work in an average week?

____
40-41

How many of those hours do you work at home?

____
42-43

Are the total number of hours that you work at home, per week:

44-1☐ fairly regular (within 5 hours) week to week
2☐ very irregular week to week

Is the amount of time you spend working at home: (Please check only one answer.)

45-1☐ up to you
2☐ limited, or set, by an employer or primary client
3☐ dependent on how much paid work you can find to do
4☐ other - please specify

Would you prefer to work at home :

46-1☐ more hours
2☐ fewer hours
3☐ about this much

Are the hours you work at home (check only one answer):

47-1☐ all the paid work I do
2☐ a full-time substitute for working at another location
3☐ a part-time substitute for working at another location
4☐ overtime work from work done at another location

Are the hours you work at home regular hours from day to day?

48-1☐ Yes 2☐ No

If yes, during what hours do you regularly or often work (Please check all that apply):

49☐ before 8 am
50☐ any hours between 8 am - 5 pm
51☐ any hours between 5 pm - 9 pm
52☐ after 9 pm
53☐ other - please specify:

SECTION III.

Did you work outside the home before you started your homebased business?

72-1☐ Yes 2☐ No

If yes, how long ago? (Please check only one answer.)

73-1☐ immediately before
2☐ within five years of starting to work at home
3☐ over five years before starting to work at home

How did you first decide to work at home: (Please check only one answer.)

74-1☐ developed the idea by myself
2☐ was offered an opportunity by previous/present employer or major client
3☐ inherited or took over business from someone else
4☐ other - please specify

Did you have formal training in the work you now do? (Please check only one answer.)

75-1 ☐ no
2 ☐ yes, in college
3 ☐ yes, in highschool vocational school
4☐ yes, was given training in previous employment
5☐ yes, received training under a government program
6☐ yes, took course voluntarily
7☐ other - please specify

Why did you decide initially to work at home? (Please check all that apply.)

76☐ my husband/partner did not want me working outside of home
77☐ to take care of my family
78☐ to save time commuting
79☐ to save money on work expenses, such as commuting and clothes
80☐ low overhead and tax advantages
81☐ to avoid office politics and distractions
82☐ to increase my social contacts through work
83☐ to work in my own way at my own pace
84☐ to increase job or career opportunities
85☐ to increase my productivity
86☐ to earn extra money
87☐ physical handicap
88☐ wanted to lessen personal conflict over working and taking care of my family
89☐ other - please specify

Which of the above reasons was the most important to you? (Please indicate its number from the above list here):

______
90-91

Overall, do you think: (Please check only one answer.)

129-1☐ the benefits of working at home are greater than the problems
2☐ the problems of working at home are greater than the benifits

Where is the one place in your home where you most often conduct your business (Please check only one answer.)

130-1☐ separate room/office
2☐ living room
3☐ family room
4☐ dining room
5☐ kitchen
6☐ bedroom
7☐ basement
8☐ other - please specify

Do you have a separate desk or table in that place for your work?

131-1☐ Yes 2☐ No

If you have children five years and younger, do you use supplemental child care during your working hours?

132-1☐ Yes 2☐ No

If yes, please check which: (Please check only the one you most often use.)

133-1☐ baby sitter, part-time
2☐ baby sitter, full-time
3☐ live-in help
4☐ child care home or center, part-time
5☐ child care home or center, full-time
6☐ help from husband/partner
7☐ help by older children, unpaid
8☐ help by other relatives, unpaid
9☐ other - please specify

Who does most of the housework during an average week? (Please check only one answer.)

134-1☐ I do
2☐ shared by me and husband/partner
3☐ shared by me, husband/partner and children
4☐ shared by me and children
5☐ shared by husband/partner and children
6☐ husband/partner
7☐ children
8☐ paid help
9☐ other - please specify

Is your current housework arrangement different from when you worked outside or did no paid work?

135-1☐ Yes 2☐ No

What work-related tasks do you use your equipment for? (Please check all that apply.)

147☐ data entry
148☐ word processing
149☐ budgeting
150☐ business planning and forecasting
151☐ communications, such as through electronic mail
152☐ composing (journalism, creative writing, etc)
153☐ analysis and research
154☐ other - please specify:

If you did not have access to computer equipment could you continue to work at home?

155-1☐ yes, definitely
2☐ maybe, but it would be difficult
3☐ no, it would be impossible

SECTION V.

Are you:

156-1☐ female 2☐ male

Are you currently:

157-1☐ married, living with spouse
2☐ separate
3☐ divorced
4☐ widow(er)
5☐ single (never married)
6☐ single, living with partner

How many children do you have?

____
158-159

How many children live with you, who are:

160 _____ under 5 years
161 _____ 5 - 13 years
162 _____ 14 - 17 years
163 _____ over 18 years

If you were to decide to go to work outside your home, would acceptable child care facilities to available in your community?

164-1☐ Yes 2☐ No 3☐ Don't know

March 27 1985

Kathleen E. Christensen
Graduate Center, City University of New York
33 West 42nd Street, New York, New York 10036

Results of National Survey on Computer Technology in Home-based Business

This survey was mailed to 1200 members of the National Alliance of Home-based Business Women (NAHB), in October 1984. Kathleen Christensen, Graduate Center, City University of New York, was responsible for the survey design, distribution, and analysis of results. The survey was supported by the Office of Technology Assessment, U.S. Congress, as part of their Office Automation study, contract number

Total Number of Respondents: 215

Response Rate: 18%

I. TOTAL SAMPLE OF WOMEN RESPONDENTS (n = 213)

A. Number of respondents who currently own a home-based business or work in their homes:

	Frequency	Percent
Yes	213	100
No	0	0

B. Number of respondents who use computer equipment in their businesses:

	Frequency	Percent
Yes	119	55.9
No	94	44.1

II. COMPUTER USERS SAMPLE (n = 119)

Occupation

What is your current occupation?

	Frequency	Percent
Professional	43	36.4
Service	26	22.0
Clerical	13	11.0
Craftsperson	11	9.3
Manager	10	8.5
Other	9	7.6
Sales	5	4.2
Technical	1	.8

Are the hours you work at home?

	Frequency	Percent
All the paid work you do	89	80.9
Part-time substitute for working at another location	13	11.8
Full-time substitute for working at another location	7	6.4
Overtime work from work done at another location	1	.9

What percentage of your family income is provided by your work at home?

	Frequency	Percent
Less than 25%	64	56.0
25% - 49%	23	19.8
75% - 99%	10	8.6
50% - 74%	9	7.8
100%	9	7.8

Is the rest of your income from:

	Frequency	Percent
Husband or partner's income	97	81.5
Other employment of your own	19	16.0
Other	12	10.1
Your own pension	3	2.5
Government benefits	3	2.5
Insurance payments	0	.0

Does your home-based work provide office-type services for other businesses, individuals, or organizations?

	Frequency	Percent
Does not provide office type services	60	50.4
Word processing	37	31.1
Other office type services	26	21.8
Bookkeeping	25	21.0
Data entry	19	16.0

When you work at home, are you:

	Frequency	Percent
Self-employed	99	83.9
Independent contractor	14	11.9
On the employee payroll of a company	3	2.5
Other	2	1.7

Computer Equipment Used in Work

Which type of computer equipment do you have at home for work related use?

	Frequency	Percent
Personal computer	102	85.7
Word processor	41	34.5
Modem	25	21.0
Other	12	10.1
Terminal to mainframe	6	5.0
Special dedicated phone line	3	2.5

Who owns the equipment?

	Frequency	Percent
I do or family does	109	93.2
Employee or client	4	3.4
Other	4	3.4
Rental	0	.0

Did you:

	Frequency	Percent
Begin this kind of work and then get equipment	57	51.8
Start from scratch to acquire equipment and build a business	33	30.0
Begin this kind of work because you had the equipment	20	18.2

What work related tasks do you use your equipment for?

	Frequency	Percent
Word processing	99	83.2
Composing	63	52.9
Data entry	53	44.5
Budgeting	29	24.4
Other	26	21.8
Business planning and forecasting	24	20.2
Analysis and Research	20	16.8
Communication (electronic mail)	18	15.1

If you did not have access to computer equipment could you continue to work at home?

	Frequency	Percent
Yes, definitely	63	57.0
Maybe, but it would be difficult	26	22.8
No, it would be impossible	23	20.2

Demographic Characteristics

Sex:

	Frequency	Percent
Female	119	100.0
Male	0	.0

Marital status:

	Frequency	Percent
Married, living with spouse	99	83.2
Separated, divorced, widowed	12	10.1
Single, never married	3	2.5
Single, living with partner	5	4.2

Average number of children living at home: 2.1

Household income:

	Frequency	Percent
25,000 - 49,999	48	42.5
over 50,000	46	40.7
15,000 - 24,999	10	8.9
5,000 - 14,999	6	5.3
under 4,999	3	2.7

Age of women:

	Frequency	Percent
Under 24 years	0	.0
25 - 39 years	61	51.3
40 - 54 years	48	40.3
over 55 years	10	8.4

Race and ethnic background:

	Frequency	Percent
White	114	95.8
Black	3	2.5
Hispanic	2	1.7

Work Patterns, Payment and Benefits

How many hours do you work in an average week?

Mean: 36.2 hours (standard deviation of 16.9)
Median: 35.0 hours

How many of those hours do you work at home?

Mean: 28.5 hours (standard deviation of 16.2)
Median: 25.0 hours

APPENDIX C

Semi-structured Protocols in In-depth, In-person Interviews

Demographic Characteristics

Sex:

	Frequency	Percent
Female	119	100.0
Male	0	.0

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Median: 25.0 hours

SEMI-STRUCTURED PROTOCOLS FOR TASK 3: OTA STUDY OF HOME-BASED OFFICE WORK: EFFECTS ON WORKERS AND FAMILIES

1. INITIALLY, I WOULD LIKE TO ASK YOU SOME BACKGROUND QUESTIONS:

   a. employed/self-employed/independent contractor

   b. marital status; occupation of husband/partner

   c. children: number, age, and place of residence

   d. racial/ethnic background

2. WHAT KIND OF WORK DO YOU DO AT HOME?

   a. how long have you worked at home?

   b. did you work outside the home, before you worked here? (If yes): how long ago? did you do the same kind of work that you now do? (If no): why did you change?

   c. how are you paid for your work?

3. WHAT KIND OF COMPUTER TECHNOLOGY DO YOU USE IN YOUR WORK?

   a. what do you use it for? how many hours a day do you work on it? (have her elaborate on how her work involves this technology)

   b. could you work at home, if you did not have access to the technology?

   c. who owns it?

   d. (If employed): do you use the technology to communicate with colleagues and supervisors? are there special advantages or problems?

4. (IF WOMAN IS EMPLOYED): WHAT IS YOUR WORKING ARRANGEMENT WITH YOUR EMPLOYER?

   a. how are you supervised? how are work products defined?

   b. how often do you go into an office?

   c. what are your relationships like with your co-workers or colleagues?

   d. do you think that you are at an advantage or a disadvantage to your co-workers who: (1) work at home; (2) work in a central office.

5. WHY DID YOU INITIALLY DECIDE TO WORK AT HOME?

   a. whose idea was it for you to work at home? did you have help getting started?

   b. what were the reasons for working at home? (probe for how critical the technology was to the decision)

c. (after she has listed them): which was the most important reason to you?

6. WHAT ARE THE CURRENT ADVANTAGES OF WORKING AT HOME?

a. (after she has listed them): which do you consider the most important?

b. (if she has worked outside of the home): how do the advantages of working at home compare to when you used to work outside the home?

c. (if she owns her own business): can you separate the advantages of working at from the advantages of owning your own business?

7. WHAT ARE THE CURRENT DISADVANTAGES OF WORKING AT HOME?

a. (after she has listed them): which do you consider the most important?

b. (if she has worked outside the home): how do the disadvantages of working at home compare to when you used to work outside the home?

c. (if she owns her own business): do the disadvantages of working at home have more to do with working at home or with owning your own business?

8. WHERE IN YOUR HOME DO YOU MOST OFTEN WORK?

a. (ask her to draw a floor plan of her house, locating work areas. ask her to elaborate on where she works, when she works there, and the advantages or disadvantages of those workplaces)

9. WHAT KINDS OF HOURS DO YOU WORK EACH DAY?

a. when does your day begin? when does it end?

b. are the hours regular day to day? (if no): why are they variable and how variable are they? (if regular, get different variations)

c. how many day a week do you work? how do you decide how many days? (probe to see if it depends on nature of work, employers' demands, or family responsibilities)

d. do you take vacations? (if she has worked outside the home, ask how her current vacation pattern varies)

e. (if she owns her business): are you working these hours because of the stage of your business? if it was at a different stage, would you work more or less?

10. I WOULD LIKE TO ASK YOU A LITTLE MORE ABOUT HOW YOU THINK HOME-BASED WORK HAS AFFECTED YOUR JOB OR CAREER OPPORTUNITIES.

a. do you think that working at home has increased or decreased your opportunities? (have her elaborate this answer)

b. (if she thinks it has decreased her options): does that matter to you. could you do anything differently? why do you continue to work at home?

c. (if this has not already been asked): has it affected your relationships with co-workers or colleagues?

11. NOW, I WOULD LIKE TO ASK YOU HOW YOU THINK WORKING AT HOME HAS AFFECTED YOUR RELATIONSHIP WITH YOUR CHILDREN AND (when applicable) HUSBAND/PARTNER?

a. how do you think, overall, it has affected your children?

b. who takes care of your children while you work? are you satisfied with this arrangement? would you like it to be different, and how?

c. has working at home affected where the children play or study, or when they do either?

d. do your children help with your work? (if yes): how, and are they paid to do so?

e. from what you can gather, how do your children feel about your working at home?

f. what about your husband/partner? how does he feel about your working at home? would he like there to be a different arrangement? (probe for incidents or anecdotes supporting her opinions)

g. do you feel that working at home has affected your relationship with your children and husband? (if she answers no; say): "so you are saying that everything is the same now that you work at home, as it was before you did so" (if she answers yes: ask her): "how?" and probe

h. has working at home affected your meal times, or weekends? (if she worked outside of the home, probe how it is now different; if she had not worked before, probe for how it is different).

i. what about housework? who does it on a regular basis? has it changed since you started to work at home? if so, how?

12. I'D LIKE TO NOW DISCUSS WORKER BENEFITS?

a. are you covered by health insurance?

b. (if yes): how are you covered? (probe to see if self-paid program, husband's program, employer's or own business program). (if employers, ask): what percentage does the employer contribute? (also probe to assess the extensiveness of the coverage)

c. does your work provide you with a retirement or pension plan? (probe this)

d. has medical coverage or pension plans posed any problems to you as a home-based worker? (if yes): ask how

13. WHAT WOULD BE YOUR IDEAL WORKING ARRANGEMENT?

a. (let her talk, but then probe for): where would you work? when would you do so? how would the children be cared for? how would others accept your work?

14. SOME FINAL BACKGROUND QUESTIONS:

a. roughly what percentage of your household income comes from your home-based work? (ask what makes up the rest; give possibilities, such as: husband's income, pension or insurance, savings, etc.)

b. could you look at this card and tell me what range your household income falls into? (card with following ranges printed on it: less than $4,999; 5,000 - 14,999; 15,000 - 24,999; 25,000 - 49,999; over 50,000)

15. ALL IN ALL, GIVEN THE CHOICE, WOULD YOU CONTINUE TO WORK AT HOME IN THE FUTURE? WOULD YOU RECOMMEND IT TO A FRIEND?

16. IN CLOSING, ARE THERE ANY QUESTIONS YOU WOULD LIKE TO ASK ME?

THANK YOU VERY MUCH

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